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An Interworld Highway, LLC Company

# TG700
# TV Signal Generator Platform

## Service Manual

077-0230-04

Tektronix

# TG700
# TV Signal Generator Platform

## Service Manual

www.tektronix.com
077-0230-04

Tektronix

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# General Safety Summary

Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it.

To avoid potential hazards, use this product only as specified.

*Only qualified personnel should perform service procedures.*

## To Avoid Fire or Personal Injury

**Use proper power cord.** Use only the power cord specified for this product and certified for the country of use.

**Ground the product.** This product is grounded through the grounding conductor of the power cord. To avoid electric shock, the grounding conductor must be connected to earth ground. Before making connections to the input or output terminals of the product, ensure that the product is properly grounded.

**Observe all terminal ratings.** To avoid fire or shock hazard, observe all ratings and markings on the product. Consult the product manual for further ratings information before making connections to the product.

**Power disconnect.** The power cord disconnects the product from the power source. Do not block the power cord; it must remain accessible to the user at all times.

**Do not operate without covers.** Do not operate this product with covers or panels removed.

**Do not operate with suspected failures.** If you suspect that there is damage to this product, have it inspected by qualified service personnel.

**Avoid exposed circuitry.** Do not touch exposed connections and components when power is present.

**Do not operate in wet/damp conditions.**

**Do not operate in an explosive atmosphere.**

**Keep product surfaces clean and dry.**

**Provide proper ventilation.** Refer to the manual's installation instructions for details on installing the product so it has proper ventilation.

## Terms in This Manual

These terms may appear in this manual:

***WARNING.*** *Warning statements identify conditions or practices that could result in injury or loss of life.*

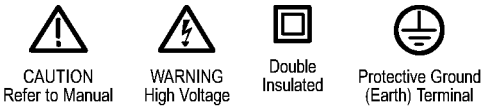
***CAUTION.*** *Caution statements identify conditions or practices that could result in damage to this product or other property.*

## Symbols and Terms on the Product

These terms may appear on the product:

- DANGER indicates an injury hazard immediately accessible as you read the marking.
- WARNING indicates an injury hazard not immediately accessible as you read the marking.
- CAUTION indicates a hazard to property including the product.

The following symbol(s) may appear on the product:



# Service Safety Summary

Only qualified personnel should perform service procedures. Read this *Service Safety Summary* and the *General Safety Summary* before performing any service procedures.

**Do Not Service Alone.** Do not perform internal service or adjustments of this product unless another person capable of rendering first aid and resuscitation is present.

**Disconnect Power.** To avoid electric shock, switch off the instrument power, then disconnect the power cord from the mains power.

**Use Care When Servicing With Power On.** Dangerous voltages or currents may exist in this product. Disconnect power, remove battery (if applicable), and disconnect test leads before removing protective panels, soldering, or replacing components.

To avoid electric shock, do not touch exposed connections.

# Preface

This is the service manual for the TG700 TV Signal Generator Platform and associated modules. This manual contains information needed to service a TG700 and its modules to the module level.

## Manual Structure

This manual is divided into sections. Each section contains information about the mainframe or a module. Further, sections are divided into subsections.

Read the introductions to the procedures you find in each subsection. They provide information you need to perform the service correctly and efficiently.

Each section in this manual contains the following subsections:

- *Theory of Operation* contains circuit descriptions that support service to the module level.
- *Adjustment Procedures* contains procedures for adjusting a TG700 to meet warranted characteristics.
- *Removal Procedures* contains procedures to safely remove replaceable modules from the mainframe and product modules.
- *Maintenance* contains information and procedures for performing preventive and corrective maintenance for a TG700. These instructions include cleaning, module removal and installation, and fault isolation to the module level.
- *Troubleshooting* contains information and procedures to help you isolate and fix various problems.
- *Diagrams* contains a block diagram and an interconnect diagram.
- *Replaceable Parts List* includes a table of all replaceable modules, their descriptions, and their Tektronix part numbers.

## Manual Conventions

This manual uses certain conventions with which you should become familiar.

Some sections of the manual contain procedures for you to perform. To keep those instructions clear and consistent, this manual uses the following conventions:

- Names of front panel controls and menus appear in the same case (initial capitals, all uppercase, etc.) in the manual as is used on the TG700 front panel and menus.
- Instruction steps are numbered unless there is only one step.

- **Bold** text refers to specific interface elements that you are instructed to select, click, or clear.
  - Example: Press the **ENTER** button to access the PRESET submenu.
- *Italic* text refers to document names or sections. Italics are also used in NOTES, CAUTIONS, and WARNINGS.
  - Example: The *Diagrams* section includes a block diagram and an interconnect diagram.

**Modules** Throughout this manual, the term module appears. A module is composed of electrical and mechanical assemblies, circuit cards, and interconnecting cables. References to a module are different than references to a product module such as "AGL7 Genlock module" which is a product installed in the TG700 mainframe.

**Safety** Symbols and terms related to safety appear in the *General Safety Summary*.

## Finding Other Information

The following documents relate to the TG700 mainframe and product modules. These documents can be located on the *TG700 Signal Generator Platform SW Library and Documentation* DVD shipped with the instruments or on the Tektronix Web site at www.tektronix.com/manuals.

- The *TG700 TV Signal Generator Platform User Manual* contains a tutorial to quickly describe how to operate the TG700. It also includes an in-depth discussion on how to more completely use the TG700 features.

  This manual is available in both English (Tektronix part number 071-1970-XX) and Japanese (Tektronix part number 071-1971-XX).
- The *TG700 TV Signal Generator Platform PC Tools Technical Reference* (Tektronix part number 077-0138-XX) describes how to use the PC tools that are available for the mainframe and related modules.
- The *TG700TV Signal Generator Platform Specifications and Performance Verification Technical Reference* (Tektronix part number 077-0137-XX) describes the mechanical, electrical, and environmental specifications for the mainframe and related modules. This manual also provides performance verification procedures.
- The *TG700 TV Signal Generator Platform Release Notes* (Tektronix part number 077-0229-XX) describes the new features, improvements, and limitations of the most recent available firmware for the TG700 TV Signal Generator Platform. This information is provided in both Japanese and English.

# Introduction

This manual contains information needed to safely and effectively service the TG700 mainframe and installed modules.

To prevent personal injury or damage to the mainframe or modules, consider the following before attempting service:

- The procedures in this manual should be performed only by a qualified service person.
- Read the *General Safety Summary* and the *Service Safety Summary*. (See page xii.) (See page xiv.)

When using this manual for servicing, be sure to follow all warnings, cautions, and notes.

## Performance Check Interval

Generally, the performance check described in the *Specifications and Performance Verification* manual, should be done every 12 months. In addition, a performance check is recommended after repair. The *Specifications and Performance Verification* manual is available on the Web, at www.tektronix.com.

If the TG700 mainframe or any installed product modules do not meet performance criteria, repair is necessary.

## Strategy for Servicing

Throughout this manual, the term module appears, referring to any field-replaceable component or assembly. References to a module are different than references to a product module such as “AGL7 Genlock module” which is a product installed in the TG700 mainframe.

This manual contains all the information needed for periodic maintenance of the TG700 mainframe and installed product modules. (Examples of such information are procedures for performing adjustments.)

Further, the manual contains information for corrective maintenance down to the module level. To isolate a failure, use the fault isolation procedures found in the troubleshooting sections for the mainframe and product modules. To remove and replace any failed module, follow the instructions in the removal procedure sections for the mainframe and product modules. After isolating a faulty module, replace it with a fully-tested module obtained from the factory. Use the replaceable parts list sections for the mainframe and product modules for part numbers and ordering information for all replaceable modules.

## Tektronix Service Offerings

Tektronix provides service to cover repair under warranty and other services that may provide a cost-effective answer to your service needs.

Whether providing warranty repair service or any of the other services listed below, Tektronix service technicians are well trained to service the TG700. They have access to the latest information on improvements to the TG700 and the latest new options.

### Warranty Repair Service

Tektronix warrants this product for one year from date of purchase. The warranty appears after the title page in this manual. Tektronix technicians provide warranty service at most Tektronix service locations. The Tektronix product catalog lists all worldwide service locations or you can visit our Web site for service information: www.tektronix.com.

### Self Service

Tektronix supports repair to the module level by providing module exchange.

**Module exchange.** This service reduces downtime for repair by allowing you to exchange most modules for remanufactured ones. Each module comes with a 90-day service warranty.

**For more information.** Contact your local Tektronix service center or sales engineer for more information on any of the repair or adjustment services just described.

# Maintenance for Generators and Modules

The following information applies to all of the generators and modules that can be used with the TG700 mainframe. Before doing maintenance procedures on any module, read the following information.

## Preparation

Read and follow these preparation instructions before attempting to perform any maintenance or service to the instrument.

### Servicing Prerequisites

Ensure the following before beginning any instrument service:

- The maintenance or service of this instrument must be performed by qualified service personnel only.
- Read the *Service Safety Summary* located at the beginning of this manual before attempting to perform any maintenance or service to the instrument.

This section contains instructions and procedures for maintaining the AG7 Generator module.

The following information can be found in this section:


- Preparation (See page xix.)
- Inspection and Cleaning (preventive maintenance) (See page xxi.)
- Repackaging Instructions (See page xxii.)
- Removal and Replacement (See page 2-3.)
- Troubleshooting (See page 1-24.)


If the instrument does not function properly, troubleshooting and corrective measures should be taken immediately to prevent additional problems.

***NOTE.*** *Contact your local Tektronix representative for information on where to return your instrument if it requires repair during the warranty period.*

### Electrostatic Damage Prevention

This instrument contains electrical components that are susceptible to damage from electrostatic discharge. Static voltages of 1 kV to 30 kV are common in unprotected environments.

***CAUTION.*** *Static discharge can damage any semiconductor component in this instrument.*

Observe the following precautions to avoid static damage:

- Minimize handling of static-sensitive components.
- Transport and store static-sensitive components or assemblies in their original containers, on a metal rail, or on conductive foam. Label any package that contains static-sensitive assemblies or components.
- Discharge the static voltage from your body by wearing a wrist strap while handling these components. Servicing static-sensitive assemblies or components should only be performed at a static-free workstation by qualified personnel.
- Nothing capable of generating or holding a static charge should be allowed on the workstation surface.
- Keep the component leads shorted together whenever possible.
- Pick up components by the body, never by the leads.
- Do not slide the components over any surface.
- Avoid handling components in areas that have a floor or work surface covering capable of generating a static charge.
- Use a soldering iron that is connected to earth ground.
- Use only special antistatic, suction-type or wick-type desoldering tools.

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***NOTE.*** *A 2% RMA flux content solder is recommended for making repairs in this instrument. Cleaning of rosin residue is not recommended. Most cleaning solvents tend to reactivate the rosin and spread it under components where it may cause corrosion under humid conditions. The rosin residue, if left alone, does not exhibit these corrosive properties.*

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## Inspection and Cleaning

Preventive maintenance consists of cleaning, visual inspection, performance verification, and, if needed, readjustment. The preventive maintenance schedule established for the instrument should be based on the environment in which it is operated and the amount of use. Under average conditions, scheduled preventive maintenance should be performed every 2000 hours of operation.

### General Care

Protect the module from adverse weather conditions. The module is not waterproof.

***CAUTION.*** *To avoid damage to this module, do not expose it to sprays, liquids, or solvents. Do not flex the circuit board if you remove the board from its mounting shield. The circuit board can be damaged by flexing. The shield provides necessary structural support to the circuit board.*

### Inspecting and Cleaning Procedures

Clean the mainframe and modules often enough to prevent dust or dirt from accumulating. Refer to *Inspecting and Cleaning Procedures*.

### Performance Verification

Check module performance after each 2000 hours of operation or every 12 months. This helps ensure maximum performance and assists in locating defects that may not be apparent during regular operation. Performance verification procedures can be found in the *TG700 Signal Generator Platform Specifications and Performance Verification Technical Reference*.

## Repackaging Instructions

Use the following instructions to prepare your instrument for shipment to a Tektronix, Inc., Service Center:

1. Attach a tag to the instrument showing: the owner, complete address and phone number of someone at your firm who can be contacted, the instrument serial number, and a description of the required service.
2. Package the instrument in the original packaging materials. If the original packaging materials are not available, follow these directions:
   a. Obtain a carton of corrugated cardboard having inside dimensions six or more inches greater than the dimensions of the instrument. Use a shipping carton that has a test strength of at least 250 pounds (113.5 kg).
   b. Surround the module with a protective (anti-static) bag.
   c. Pack dunnage or urethane form between the instrument and the carton. If using Styrofoam kernels, overfill the box and compress the kernels by closing the lid. There should be three inches of tightly packed cushioning on all sides of the instrument.
3. Seal the carton with shipping tape, industrial stapler, or both.

# TG700 Platform

# TG700 Mainframe Theory of Operation

This section describes the basic operation of the major circuit blocks or modules in the TG700. The Diagrams section, includes a block diagram and an interconnect diagram. (See page 1-28.) A diagram shows the modules and functional blocks of the TG700. (See Figure 1-13.)

Another diagram shows how the modules interconnect. (See Figure 1-14.)

## A10 Main Board

The A10 Main board consists of the following seven blocks.

**CPU & Memory** This block consists of CPU, 32 MB flash memory, and 16 MB RAM. The CPU controls the front panel, LCD display, and installed modules. It also controls execution of remote commands and downloading and uploading of signal files through the Ethernet interface. The flash memory holds the firmware data and signal data output from modules. For the Option FP another 32 MB flash memory is added, to hold frame picture data.

**D/A Converter** The block converts the digital data received from the AGL7 Analog Genlock module to analog voltage.

**Oscillator** This block generates four clock signals and supplies them to the installed modules: a 54 MHz master clock signal, a 14.43 MHz clock signal for D2, a 74.25 MHz or a 74.25/1.001 MHz clock signals for HD, and a 12.288 MHz clock signal for Audio. The master clock signal is generated from the 13.5 MHz OCXO with high accuracy. The frequency is controlled by the 16 bit D/A converter.

**Frame Pulse Generator** This block generates three frame pulses used for multi format signal generation.

**Module I/F** This block provides the interface between the TG700 and the installed modules. It provides CPU related signals such as data bus and address bus, clock signals, power, and other control signals to the modules.

**DC/DC Converter** This block converts the +5 V power, supplied by the Power Supply module, to –5 V, 3.3 V, 8 V, and 12 V.

**Network Interface** This block controls the Ethernet interface. The TG700 has a 10 BASE-T port on the rear panel.

## Power Supply Module

The Power Supply module derives the +5 V power supply voltages from the AC line and supplies it to the A10 Main board.

# TG700 Adjustment Procedures

This section contains information needed to adjust the TG700.

The only adjustment in the TG700 is for the master clock frequency.

***NOTE.*** *If your TG700 has a GPS7 GPS Synchronization and Timecode Generator module, you can use it to adjust the master clock frequency. This alternate procedure locks the master clock to a GPS signal. (See page 9-7.)*

## Requirement for Adjustment

Before proceeding, note the following requirement.

### Warm-Up Period

The TG700 requires a 20 minute warm-up time in a +20 °C to +30 °C environment before it is adjusted. Adjustments done before the operating temperature has stabilized may cause errors in performance. In addition, the signal generator requires appropriate warm-up time to meet the frequency accuracy.

## Equipment Required

The following table lists the equipment required to adjust the master clock frequency.

**Table 1-1: Equipment required for TG700 adjustment procedures**

| Item | No. | Minimum requirement | Recommended equipment |
|---|---|---|---|
| Analog genlock module | 1 | | Tektronix AGL7 |
| Signal generator | 1 | Frequency: 10 MHz ±0.05 ppm<br>Amplitude: 8 dBm | Agilent 8648A option 1E5 |
| 75 Ω BNC cable | 1 | Length: 42 inches | Tektronix part number 012-0074-00 |
| 50 Ω-to-75 Ω minimum loss attenuator | 1 | | Tektronix part number 011-0057-01 |

# Master Clock Frequency Adjustment

## Procedure

Perform the following procedure to adjust the master clock frequency.

**Initial Setup – Signal Generator:**

| | |
|---|---|
| Frequency | 10.000000 MHz |
| Output Level | 8 dBm |

**Procedure.**

1. Use the 75 Ω BNC cable and the 50 Ω -to-75 Ω minimum loss attenuator to connect the CW connector on the AGL7 Genlock module to the output connector on the signal generator as shown in the following figure.

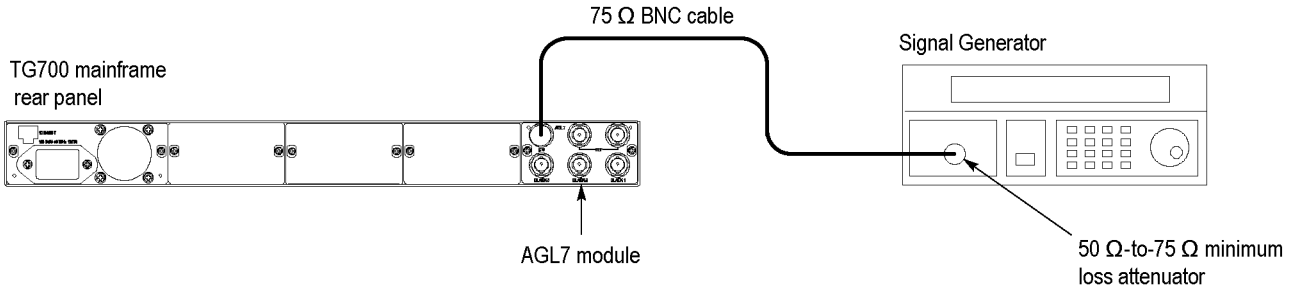



**Figure 1-1: Equipment connection for adjusting master clock frequency**

2. Press the **MODULE**, **FORMAT**, and **FRONT PANEL ENABLE** buttons simultaneously, and then release the **MODULE** and **FORMAT** buttons to restart the instrument in Factory mode.
3. Set the genlock source to CW of the AGL7 Genlock module as follows:
   a. Press the **MODULE** button to display the AGL7 main menu.
   b. Press the up (▲) or down (▼) arrow button to select **GENLOCK**, and then press the **ENTER** button to access the GENLOCK submenu.
   c. Press the left (◄) or right (►) arrow button to select **CW**, and then press the **ENTER** button.
   d. Press the **CANCEL** button to return to the AGL7 main menu.
4. Press the **MODULE** button until the TG700 main menu is displayed.
5. Press the up (▲) or down (▼) arrow button to select **UTILITY**, and then press the **ENTER** button to access the UTILITY submenu.
6. Press the up (▲) or down (▼) arrow button to select **CALIBRATION**, and then press the **ENTER** button.
7. Verify that the message **CALIBRATION result = 0xxxxx** is displayed.

This completes the master clock frequency adjustment procedures.

# TG700 Mainframe Maintenance

This section contains the information needed to do periodic and corrective maintenance on the TG700. The following subsections are included:

- *Preparation* – Introduction plus general information on preventing damage to internal modules when doing maintenance.
- *Inspection and Cleaning* – Information and procedures for inspecting the TG700 and cleaning its external and internal modules.
- *Removal and Installation Procedures* – Procedures for the removal of defective modules and replacement of new or repaired modules.
- *Troubleshooting* – Information for isolating and troubleshooting failed modules. Included are instructions for operating the TG700's internal diagnostic routines and troubleshooting trees.

## Related Maintenance Procedures

The following section contain information and procedures related to maintenance.

- *Theory of Operation* contains a circuit description at the module or block level.
- *Adjustment Procedures* addresses after repair adjustment and the interval between periodic adjustments. It contains a procedure for adjusting the master clock frequency of the TG700.
- *Diagrams* contains a block diagram using individual modules as blocks and an interconnect diagram showing connections between the modules.
- *Replaceable Parts List* lists all field replaceable modules by part number.

## Preparation

Before servicing this product, read the *Safety Summary* and *Introduction* at the front of the manual and the ESD information below.

***CAUTION.*** *Static discharge can damage any semiconductor component in the TG700.*

### Preventing ESD

When performing any service which requires internal access to the TG700, adhere to the following precautions to avoid damaging internal modules and their components due to electrostatic discharge (ESD).

1. Minimize handling of static-sensitive modules.
2. Transport and store static-sensitive modules in their static protected containers or on a metal rail. Label any package that contains static-sensitive modules.
3. Discharge the static voltage from your body by wearing a grounded antistatic wrist strap while handling these modules. Do service of static-sensitive modules only at a static-free work station.
4. Nothing capable of generating or holding a static charge should be allowed on the work station surface.
5. Handle circuit boards by the edges when possible.
6. Do not slide the modules over any surface.
7. Avoid handling modules in areas that have a floor or work-surface covering capable of generating a static charge.

## Inspection and Cleaning

*Inspection and Cleaning* describes how to inspect for dirt and damage. It also describes how to clean the exterior and interior of the TG700. Inspection and cleaning are done as preventive maintenance. Preventive maintenance, when done regularly, may prevent TG700 malfunction and enhance its reliability.

Preventive maintenance consists of visually inspecting and cleaning the TG700 and using general care when operating it.

How often preventive maintenance should be performed depends on the severity of the environment in which the TG700 is used. A proper time to perform preventive maintenance is just before TG700 adjustment.

### General Care

The top cover helps keep dust out of the TG700, and is needed to meet EMI and cooling requirements. The top cover should be in place when operating the TG700.

### Inspection and Cleaning Procedures

Inspect and clean the TG700 as often as operating conditions require. The collection of dirt on components inside can cause them to overheat and breakdown. (Dirt acts like an insulating blanket, preventing efficient heat dissipation.) Dirt also provides an electrical conduction path that could cause a TG700 failure, especially under high-humidity conditions.

***CAUTION.*** *Avoid the use of chemical cleaning agents that might damage the plastics used in this TG700. Use only deionized water when cleaning the menu buttons or front-panel buttons. Use an ethyl alcohol solution as a cleaner and rinse with deionized water.*

**Inspection – Exterior.** Inspect the outside of the TG700 for damage, wear, and missing parts, using the following table as a guide. A TG700 that appears to have been dropped or otherwise abused should be checked thoroughly to verify correct operation and performance. Immediately repair defects that could cause personal injury or lead to further damage to the TG700.

**Table 1-2: External inspection checklist**

| Item | Inspect for | Repair action |
|---|---|---|
| Cabinet, front panel, and cover | Cracks, scratches, deformations, damaged hardware or gaskets. | Repair or replace defective module. |
| Front-panel buttons | Missing or damaged buttons. | Repair or replace missing or defective buttons. |
| Connectors | Broken shells, cracked insulation, and deformed contacts. Dirt in connectors. | Repair or replace defective modules. Clear or wash out dirt. |
| Accessories | Missing items or parts of items, bent pins, broken or frayed cables, and damaged connectors. | Repair or replace damaged or missing items, frayed cables, and defective modules. |

**Cleaning Procedure – Exterior.** To clean the TG700 exterior, perform the following steps:

1. Remove loose dust on the outside of the TG700 with a lint free cloth.
2. Remove remaining dirt with a lint-free cloth dampened in a general purpose detergent-and-water solution. Do not use abrasive cleaners.
3. Clean the light filter protecting the monitor screen with a lint-free cloth dampened with a gentle, general purpose detergent-and-water solution.

***CAUTION.*** *To prevent getting moisture inside the TG700 during external cleaning, use only enough liquid to dampen the cloth or applicator.*

**Inspection – Interior.** To access the inside of the TG700 for inspection and cleaning, refer to the *Removal and Installation Procedures* in this section.

Inspect the internal portions of the TG700 for damage and wear, using the table as a guide. Defects found should be repaired immediately.

***CAUTION.*** *To prevent damage from electrical arcing, ensure that circuit boards and components are dry before applying power to the TG700.*

**Table 1-3: Internal inspection checklist**

| Item | Inspect for | Repair action |
|---|---|---|
| Circuit boards | Loose, broken, or corroded solder connections.<br>Burned circuit boards.<br>Burned, broken, or cracked circuit-run plating. | Remove failed module and replace with a fresh module. |
| Resistors | Burned, cracked, broken, blistered condition. | Remove failed module and replace with a fresh module. |
| Solder connections | Cold solder or rosin joints. | Resolder joint and clean with isopropyl alcohol. |
| Capacitors | Damaged or leaking cases.<br>Corroded solder on leads or terminals. | Remove damaged module and replace with a fresh module from the factory. |
| Semiconductors | Loosely inserted in sockets.<br>Distorted pins. | Firmly seat loose semiconductors. Remove devices that have distorted pins. Carefully straighten pins (as required to fit the socket), using long-nose pliers, and reinsert firmly. Ensure that straightening action does not crack pins, causing them to break off. |
| Wiring and cables | Loose plugs or connectors.<br>Burned, broken, or frayed wiring. | Firmly seat connectors. Repair or replace modules with defective wires or cables. |
| Chassis | Dents, deformations, and damaged hardware. | Straighten, repair, or replace defective hardware. |

**Cleaning Procedure – Interior.** To clean the TG700 interior, perform the following steps:

1. Blow off dust with dry, low-pressure, deionized air (approximately 9 psi).
2. Remove any remaining dust with a lint-free cloth dampened in ethyl alcohol and rinse with warm deionized water. (A cotton-tipped applicator is useful for cleaning in narrow spaces and on circuit boards.)

***NOTE.*** *If, after performing steps 1 and 2, a module is clean upon inspection, skip the remaining steps.*

3. If steps 1 and 2 do not remove all the dust or dirt, the TG700 may be spray washed using a solution of ethyl alcohol by performing steps 4 through 8.
4. Gain access to the parts to be cleaned by removing easily accessible shields and panels (see *Removal and Installation Procedures*).
5. Spray wash dirty parts with the ethyl alcohol and wait 60 seconds for the majority of the alcohol to evaporate.
6. Use hot deionized water to thoroughly rinse them.
7. Dry all parts with low-pressure, deionized air.
8. Dry all components and assemblies in an oven or drying compartment using low-temperature circulating air.

**Lubrication.** There is no periodic lubrication required for the TG700.

# TG700 Mainframe Removal and Installation Procedures

This subsection contains procedures for removal and installation of almost all mechanical and electrical modules. Any electrical or mechanical module, assembly, or part listed in the *Replaceable Parts List* section of this manual is a module.

## Preparation

**WARNING.** *Before performing this or any other procedure in this manual, read the Safety Summary found at the beginning of this manual. Also, to prevent possible damage to the TG700's components, read Preventing ESD in this section.*

This subsection contains the following items:

- Preparatory information that you need to properly perform the procedures that follow.
- List of tools required to remove and disassemble all modules.
- Two module locator diagrams for finding the External modules and Internal modules in the TG700. (See Figure 1-3.) (See Figure 1-4.)
- Procedures for removal and reinstallation of the electrical and mechanical modules.
- A disassembly procedure for removal of all the major modules from the TG700 at one time and for reassembly of those modules into the TG700. Such a complete disassembly is normally only done when completely cleaning the TG700. (Instructions for doing the actual cleaning are found under *Inspection and Cleaning* at the beginning of this section.)
- Module disassembly procedures.

**WARNING.** *Before performing any procedure in this subsection, disconnect the power cord from the line voltage source. Failure to do so could cause serious injury or death.*

### General Instructions

Read these general instructions before removing a module.

First read the *Summary of Procedures* that follows to understand how the procedures are grouped. Then read *Equipment Required* for a list of the tools needed to remove and install modules in the *TG700*.

If you are removing a module for service, begin by performing the *Access Procedure*. (See page 1-15.) By following the instructions in that procedure, you remove the module to be serviced while removing the minimum number of additional modules.

## Summary of Procedures

The procedures are described in the order in which they appear in this section. In addition, you can look up any procedure for removal and reinstallation of any module in the *Table of Contents*.

- The *Access Procedure* first directs you to the procedure(s) (if any) that are required to access the module to be serviced, then it directs you to the procedure to remove that module.

**Table 1-4: Summary of procedures**

| Procedure | Module | Page |
|---|---|---|
| External Modules | • Line cord | (See page 1-15.) |
| | • Top cover | |
| | • Front-panel unit | |
| | • Front-panel assembly | |
| Internal Modules | • A 10 Main board | (See page 1-20.) |
| | • Power supply module | |

**Equipment required.** Most modules in this TG700 can be removed with a screwdriver handle mounted with a #2 Phillips tip. *Use this tool whenever a procedure step instructs you to remove or install a screw unless a different size screwdriver is specified in that step.* All equipment required to remove and reinstall each module is listed in the first step of its procedure.

**Table 1-5: Tools required for module removal**

| Item No. | Name | Description |
|---|---|---|
| 1 | Screwdriver handle | Accepts Phillips-driver bits |
| 2 | #1 Phillips tip | Phillips-driver bit for #1 size screw heads |
| 3 | #2 Phillips tip | Phillips-driver bit for #2 size screw heads |
| 4 | 7 mm Nut Driver | Socket or driver for 7 mm nuts |

### TG700 Orientation

In this manual, procedures refer to "front," "rear," "top," etc. of the TG700. The following figure shows how the sides are referenced.

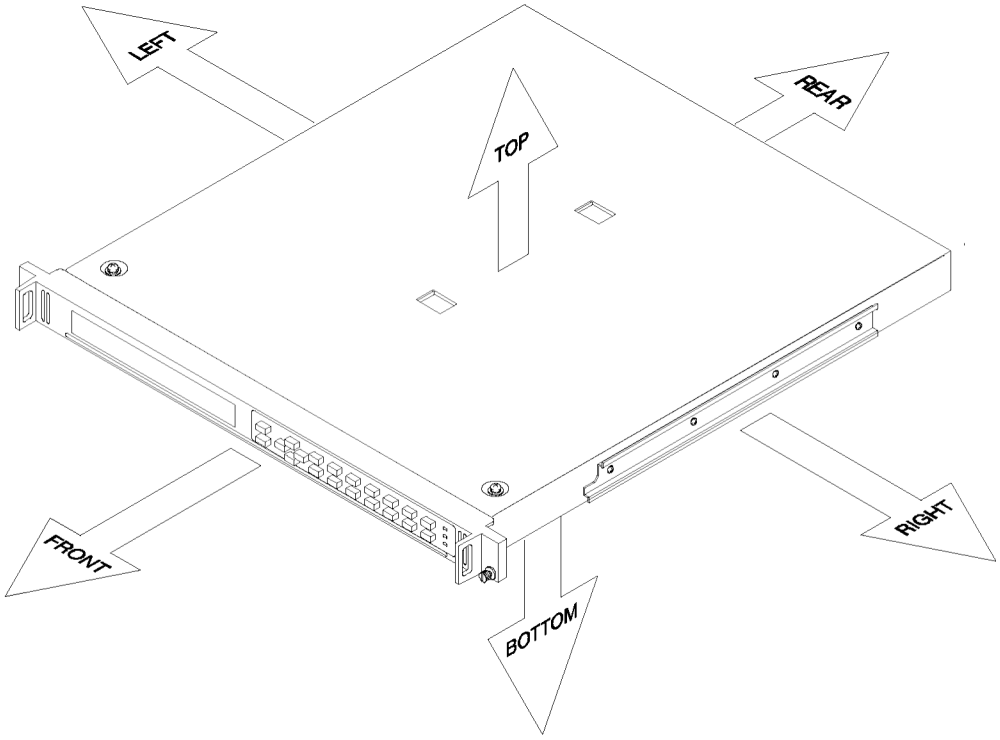



**Figure 1-2: TG700 orientation**

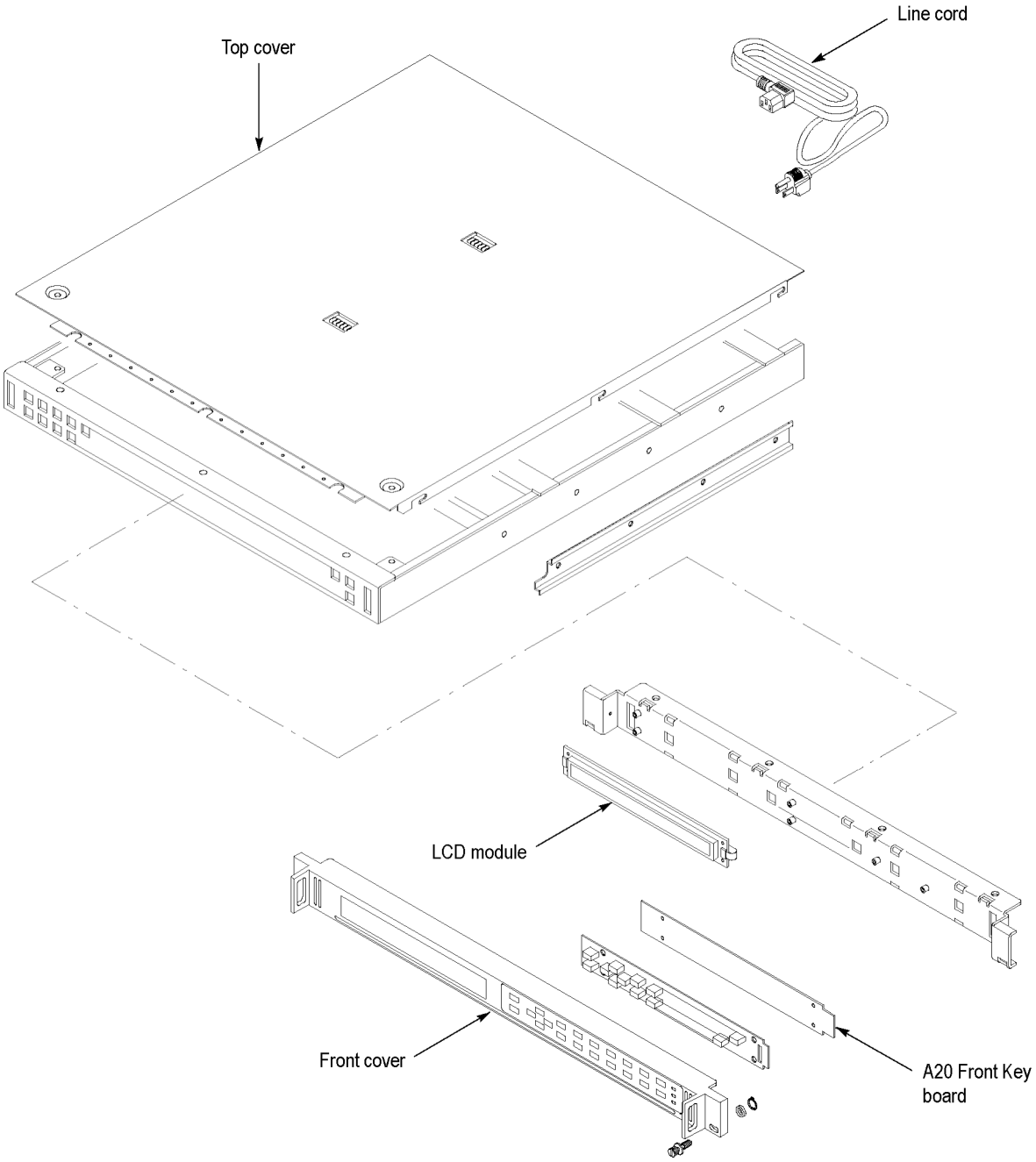



**Figure 1-3: External modules**

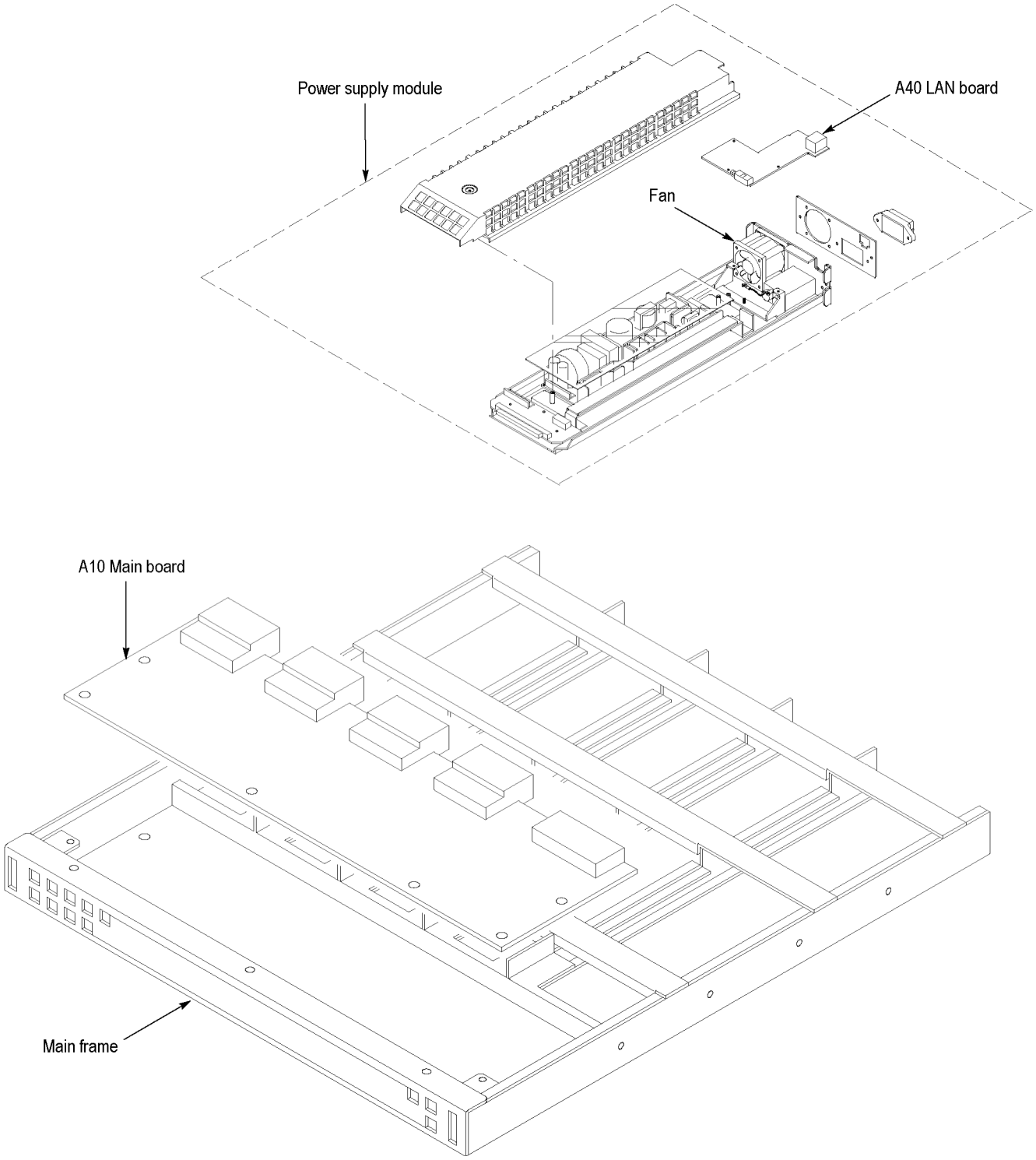



**Figure 1-4: Internal modules**

## Access Procedure

When you have identified the module to be removed for service, read *General Instructions*. (See page 1-10.) Then use the following table to determine which procedures to use for removing the module. The removal procedures end with installation instructions.

| If the module is shown in | Use this procedure |
|---|---|
| Figure 1-3, use these procedures: | Line cord (See page 1-15.) |
| | Top cover (See page 1-15.) |
| | Front-panel unit (See page 1-17.) |
| | Front-panel assembly (See page 1-18.) |
| Figure 1-4, first remove the Line Cord and Top Cover, and then use these procedures: | A10 Main board (See page 1-20.) |
| | Power supply module (See page 1-21.) |

## Procedures for External Modules

Do the *Access Procedure* before doing any procedure in this group. (See page 1-15.) This group contains the following procedures:

- *Line Cord*
- *Top Cover*
- *Front-Panel Unit*
- *Front-Panel Assembly*

### Line Cord

1. *Assemble the equipment and locate the line cord:* You need no equipment. Locate the line cord in the location diagram External Modules. (See Figure 1-3.)
2. *Orient the instrument:* Set the TG700 so its bottom is down on the work surface and its rear is facing you.
3. *Remove the line cord:* Find the line cord on the rear panel. Grasp the plug and pull the line cord and clamp away to complete the removal. Reverse procedure to reinstall.

### Top Cover

1. *Assemble equipment and locate modules to be removed:*
   a. You need a screwdriver with a #2 Phillips tip (items 1 and 3).
   b. Locate the modules to be removed in the locator diagram *External modules*. (See Figure 1-3.)
2. *Orient the instrument:* Set the TG700 so its bottom is down on the work surface and its rear is facing you.

3. *Remove the top cover:*

   a. Use a screwdriver with a #2 Phillips tip to remove the two screws securing the front of the top cover to the TG700.

   b. Slide the top cover toward the rear and then lift it off the TG700. (See Figure 1-5.)

4. *Reinstall top cover:*

   a. Perform step 3 in reverse order to reinstall the top cover.

   b. Plug the line cord into its receptacle on the rear panel. This completes the TG700 reassembly.

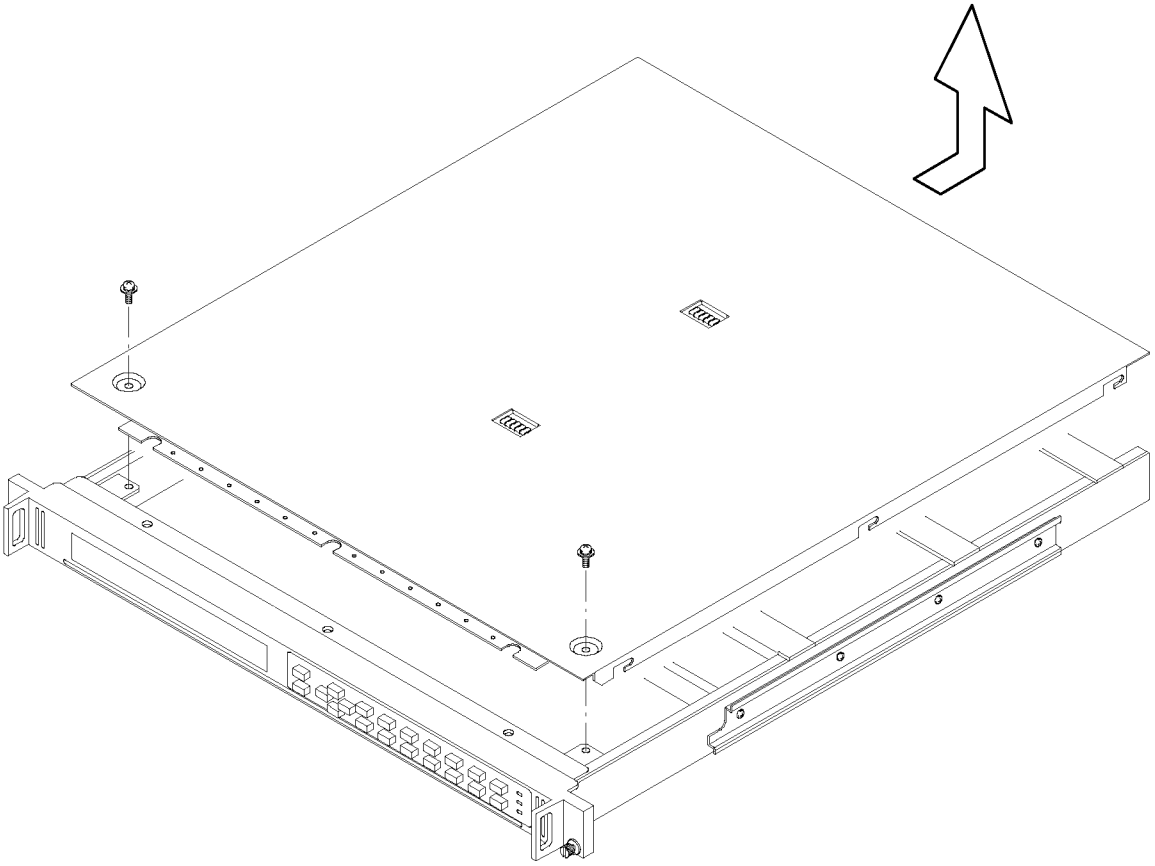


**Figure 1-5: Top cover removal**

## Front-Panel Unit

1. *Assemble equipment and locate modules to be removed:*
   a. You need a screwdriver with a #2 Phillips tip (items 1 and 3).
   b. Locate the module to be removed in the locator diagram *External modules*. (See Figure 1-3.)
2. *Orient instrument:* Set the TG700 so its bottom is down on the work surface and its front is facing you.
3. *Remove front-panel unit:* (See Figure 1-6.)
   a. Use a screwdriver with a #2 Phillips tip to remove the three screws securing the front-panel unit to the top of the chassis.
   b. Set the TG700 so its top is down on the work surface and its front is facing you.
   c. Use a screwdriver with a #2 Phillips tip to remove the four screws securing the front-panel unit to the bottom of the chassis.
   d. Set the TG700 so its bottom is down on the work surface and its front is facing you.
   e. Unplug the cables at J710, J720, and J725 on the A10 Main board.
   f. Grasp the front-panel unit and pull it forward.
4. *Reinstallation:* Perform step 3 in reverse order to reinstall the front-panel unit.

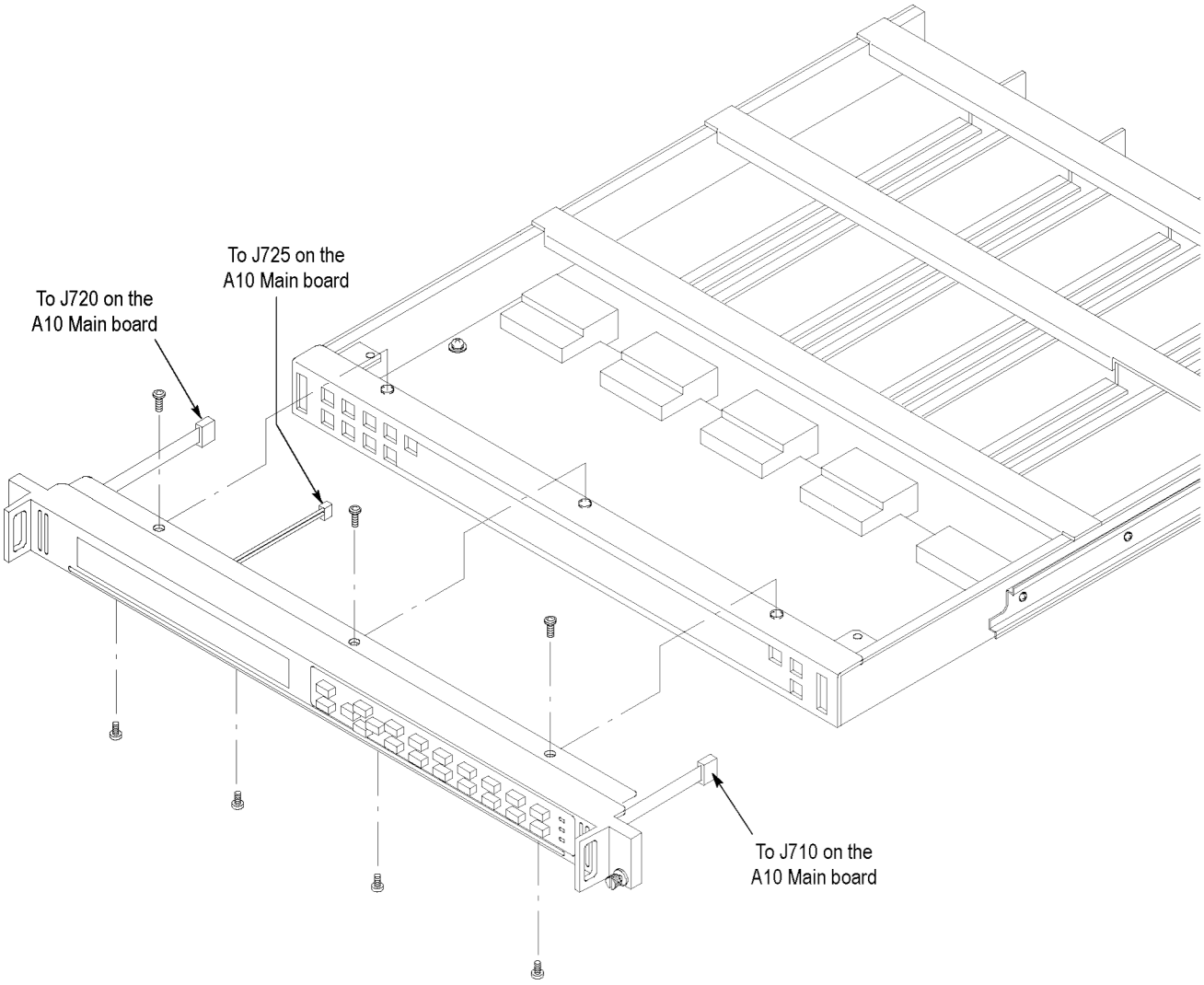



**Figure 1-6: Front-panel unit removal**

## Front-Panel Assembly

1. *Assemble equipment and locate modules to be removed:*
   - **a.** You need a screwdriver with a #2 Phillips tip (items 1 and 3).
   - **b.** Locate the module to be removed in the locator diagram *External modules*. (See Figure 1-3.)
2. *Remove the Front Cover:* (See Figure 1-7.)
   - **a.** Use a screwdriver with a #2 Phillips tip to remove the two screws securing the front cover to the left and right sides of the front frame.
   - **b.** Grasp the front cover and pull it forward.

3. *Remove the A20 Front Key board:* (See Figure 1-7.)
   a. Use a screwdriver with a #2 Phillips tip to remove the four screws securing the A20 board to the front cover.
   b. Lift the board away.
4. *Remove the LCD module:* (See Figure 1-7.)
   a. Use a screwdriver with a #2 Phillips tip to remove the four screws securing the LCD module to the front frame.
   b. Lift the board away.
5. Now hand disassemble the front-panel assembly components. (See Figure 1-7.) Reverse the procedure to reassemble.
6. *Reinstallation:* Perform steps 2 through 5 in reverse order to reinstall the front-panel assembly.

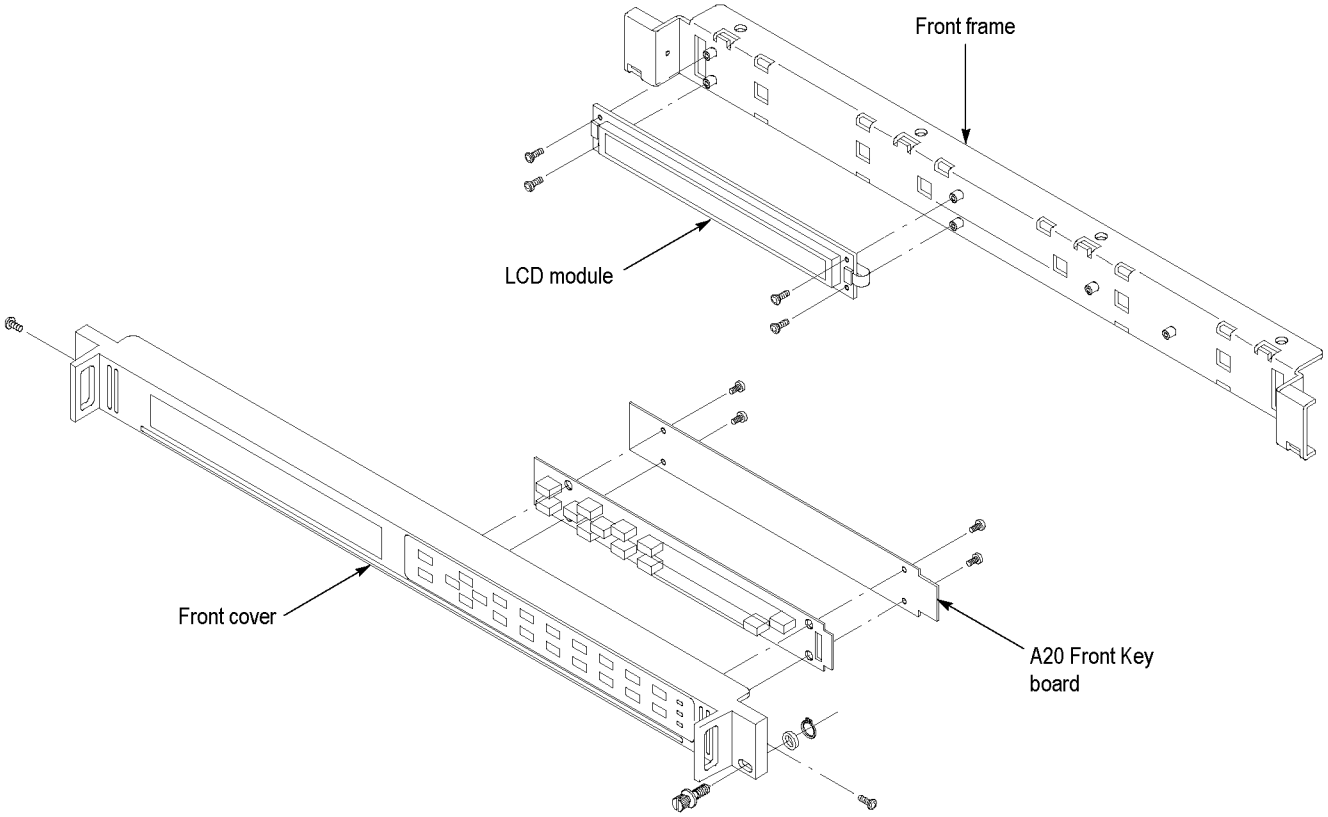



**Figure 1-7: Disassembly of front-panel assembly**

## Procedure for Internal Modules

Perform the *Access Procedure* before doing any procedure in this group. (See page 1-15.) The procedures are:

- *A10 Main Board*
- *Power Supply Module*

### A10 Main Board

1. *Assemble equipment and locate modules to be removed:*
   a. You need a screwdriver with a #2 Phillips tip (items 1 and 3).
   b. Locate the module to be removed in the locator diagram *Internal modules*. (See Figure 1-4.)
2. *Orient the instrument:* Set the TG700 so its bottom is down on the work surface and its right side is facing you.
3. *Remove the A10 Main board:* (See Figure 1-8.)
   a. Unplug these cables:
      - The cables from the LCD module at J720 and J725.
      - The cable from the A20 Front Key board at J710.
   b. Use a screwdriver with a #2 Phillips tip to remove the eight screws securing the A10 Main board to the chassis.
   c. Lift the board up and away from the chassis to complete the removal.
4. *Reinstallation*: Do step 2 in reverse order to reinstall the A10 Main board.

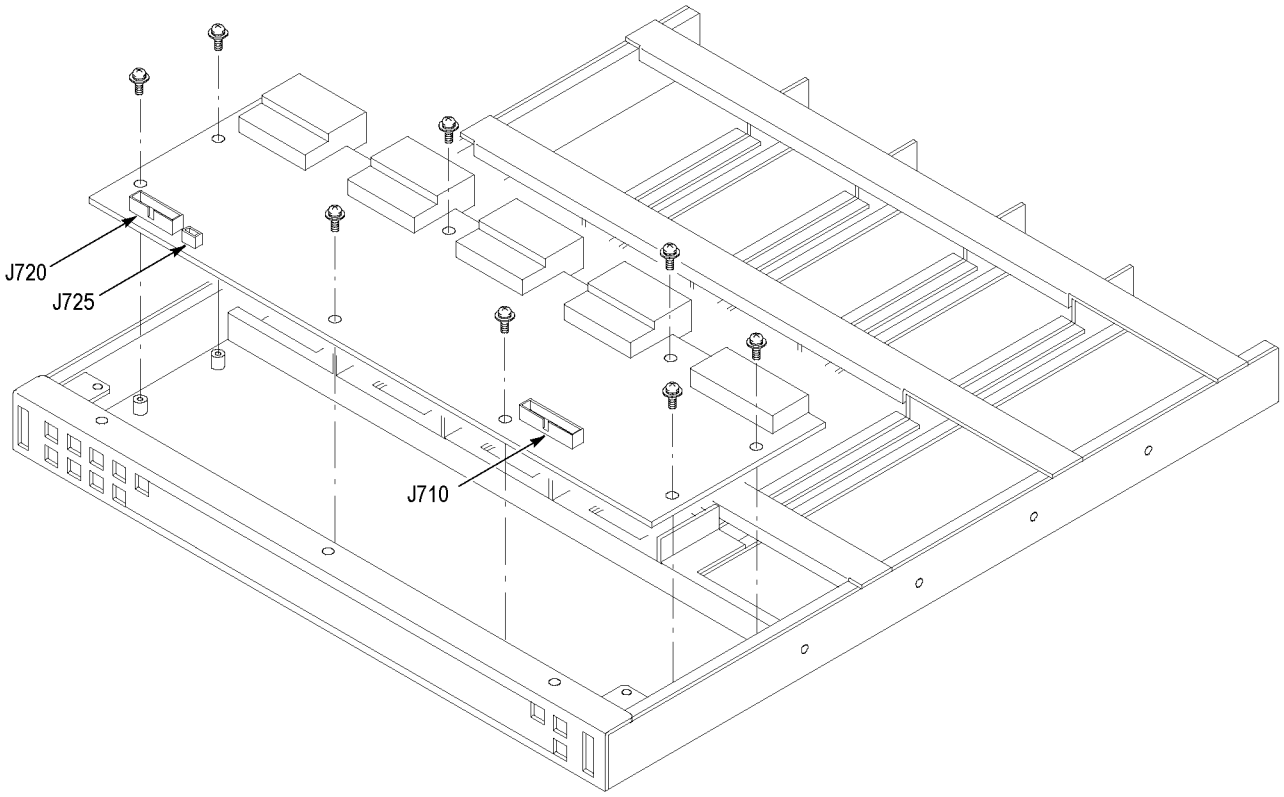



**Figure 1-8: A10 Main board removal**

## Power Supply Module

- *A40 LAN board*
- *Fan*
- *RFI filter*

1. *Assemble equipment and locate modules to be removed:*
   a. You need screwdrivers with #1 and #2 Phillips tips (items 1, 2, and 3), and a 7 mm nut driver (item 4).
   b. Locate the module to be removed in the locator diagram *Internal modules*. (See Figure 1-4.)
2. *Orient the instrument:* Set the TG700 so its bottom is down on the work surface and its back is facing you.
3. *Remove the power supply module:*
   a. Use a screwdriver with a #1 Phillips tip to loosen the two screws securing the power supply module to the mainframe.
   b. Pull the module slowly in a horizontal direction back from the mainframe.

4. *Remove the **A40 LAN board***: (See Figure 1-9.)

   a. Use a screwdriver with a #2 Phillips tip to remove the screw securing the top cover to the chassis.

   b. Lift the cover up and away from the chassis to complete the removal.

   c. Unplug the cable from the fan at J120 on the A40 LAN board.

   d. Unplug the cable from the A30 POWER CONNECT board at J110 on the A40 LAN board. When reconnecting this cable, make sure that it is completely within the cable guide.

   e. Use a screwdriver with a #2 Phillips tip to remove the three screws securing the A40 LAN board to the chassis.

   f. Lift the board up and away from the chassis to complete the removal.

5. *Remove the **Fan***: (See Figure 1-9.)

   a. Unplug the fan's power cable from J120 on the A40 LAN board.

   b. Use a screwdriver with a #2 Phillips tip to remove the four screws securing the fan to the chassis.

   c. Lift the fan up and away from the chassis to complete the removal.

6. *Remove the **RFI filter***: (See Figure 1-9.)

   a. Unplug the two cables from the RFI filter.

   b. Use a 7 mm nut driver to remove the nut securing the ground lead to the chassis.

   c. Use a screwdriver with a #2 Phillips tip to remove the two screws securing the RFI filter to the chassis.

   d. Pull the RFI filter away.

7. *Reinstallation*:

   a. Perform steps 4 through 6 in reverse order to install all the modules.

   b. Perform step 3 in reverse order to reinstall the power supply module.

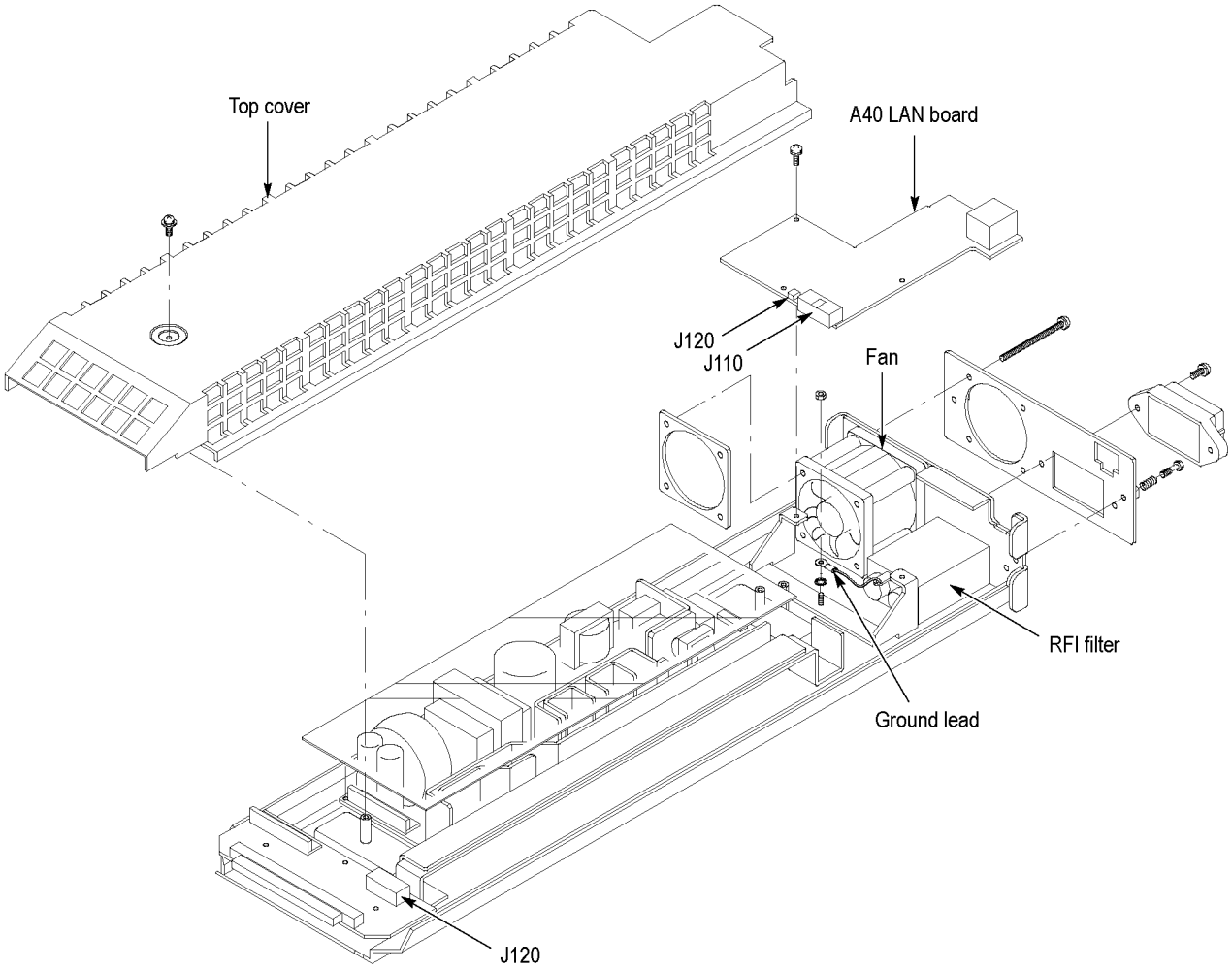



**Figure 1-9: A40 LAN board, fan, and RFI filter removal**

# TG700 Mainframe Troubleshooting

This section contains information about diagnostics and troubleshooting trees designed to isolate faulty modules in the TG700.

## Diagnostics

The TG700 has internal diagnostics that verify memory functionality. These diagnostics execute read/write tests for the signal memory of the following modules:

- HDVG7
- DVG7
- BG7 Option CB

***CAUTION.*** *When you execute the diagnostics, be sure to save the current instrument settings to a preset, and then recall the settings after the diagnostics is completed.*

Perform the following procedures to execute the diagnostics:

1. Power on (plug in) the TG700 with the **FRONT PANEL ENABLE** button pressed. This starts up the instrument in Factory mode.
2. Wait until initialization of the mainframe and installed modules is completed. Check that no error messages appear on the display.
3. Press the up (▲) and down (▼) arrow button to select **UTILITY**, and then press the **ENTER** button to access the UTILITY submenu.
4. Press the up (▲) and down (▼) arrow button to select **DIAGNOSTICS**, and then press the **ENTER** button to access the DIAGNOSTICS submenu.
5. Press the left (◄) or right (►) arrow button to select **Memory**, and then press the **ENTER** button to execute the memory test.
6. Check that the message **Pass:All Install Module(s)** is displayed on the display.

   If the message **Fail: "a module name" Diag error** is displayed, replace the module.

## Troubleshooting Trees

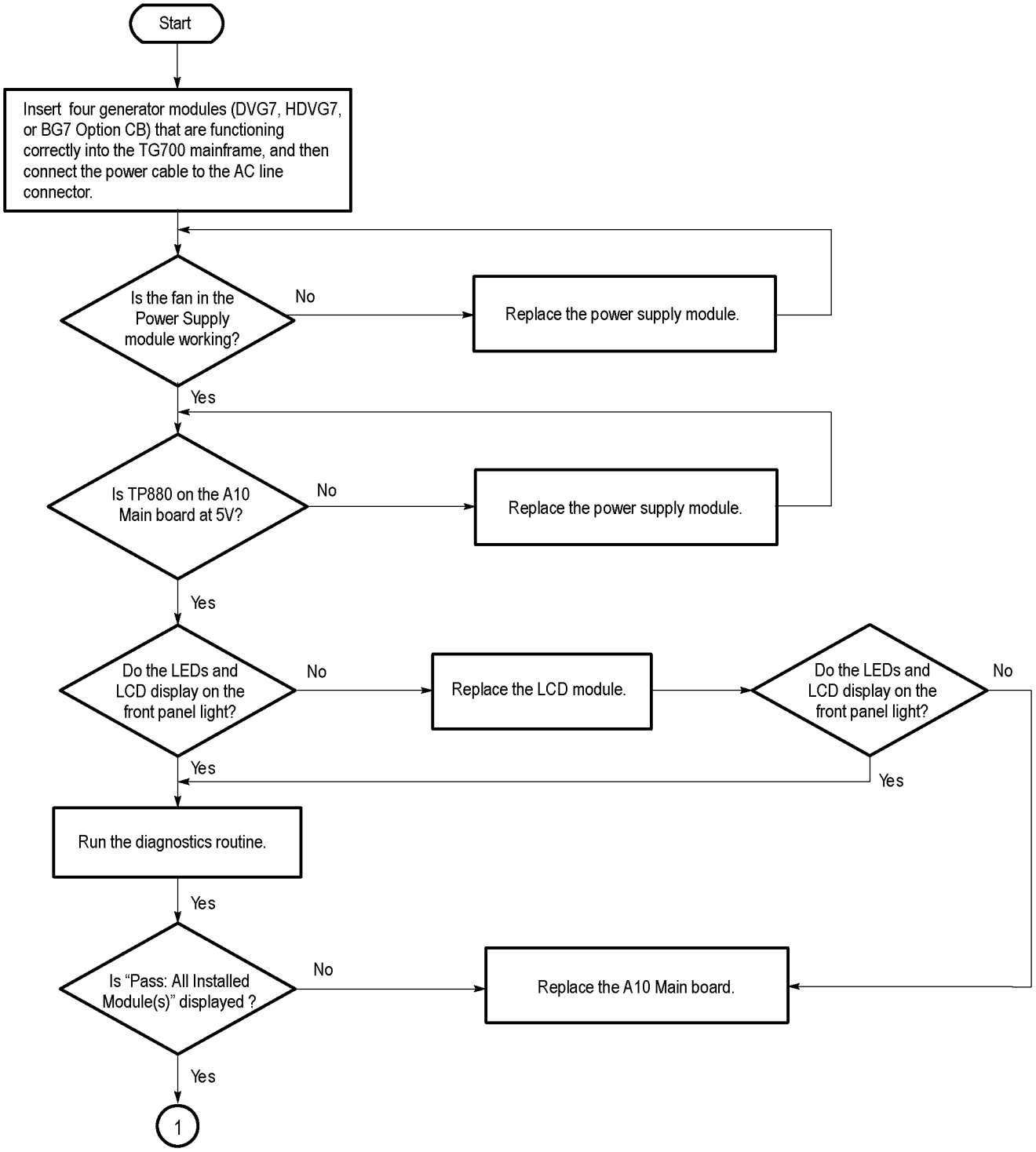

Start
Insert four generator modules (DVG7, HDVG7, or BG7 Option CB) that are functioning correctly into the TG700 mainframe, and then connect the power cable to the AC line connector.
Is the fan in the Power Supply module working?
No
Replace the power supply module.
Yes
Is TP880 on the A10 Main board at 5V?
No
Replace the power supply module.
Yes
Do the LEDs and LCD display on the front panel light?
No
Replace the LCD module.
Do the LEDs and LCD display on the front panel light?
No
Yes
Yes
Run the diagnostics routine.
Yes
Is "Pass: All Installed Module(s)" displayed ?
No
Replace the A10 Main board.
Yes
1

**Figure 1-10: Troubleshooting procedure (1)**

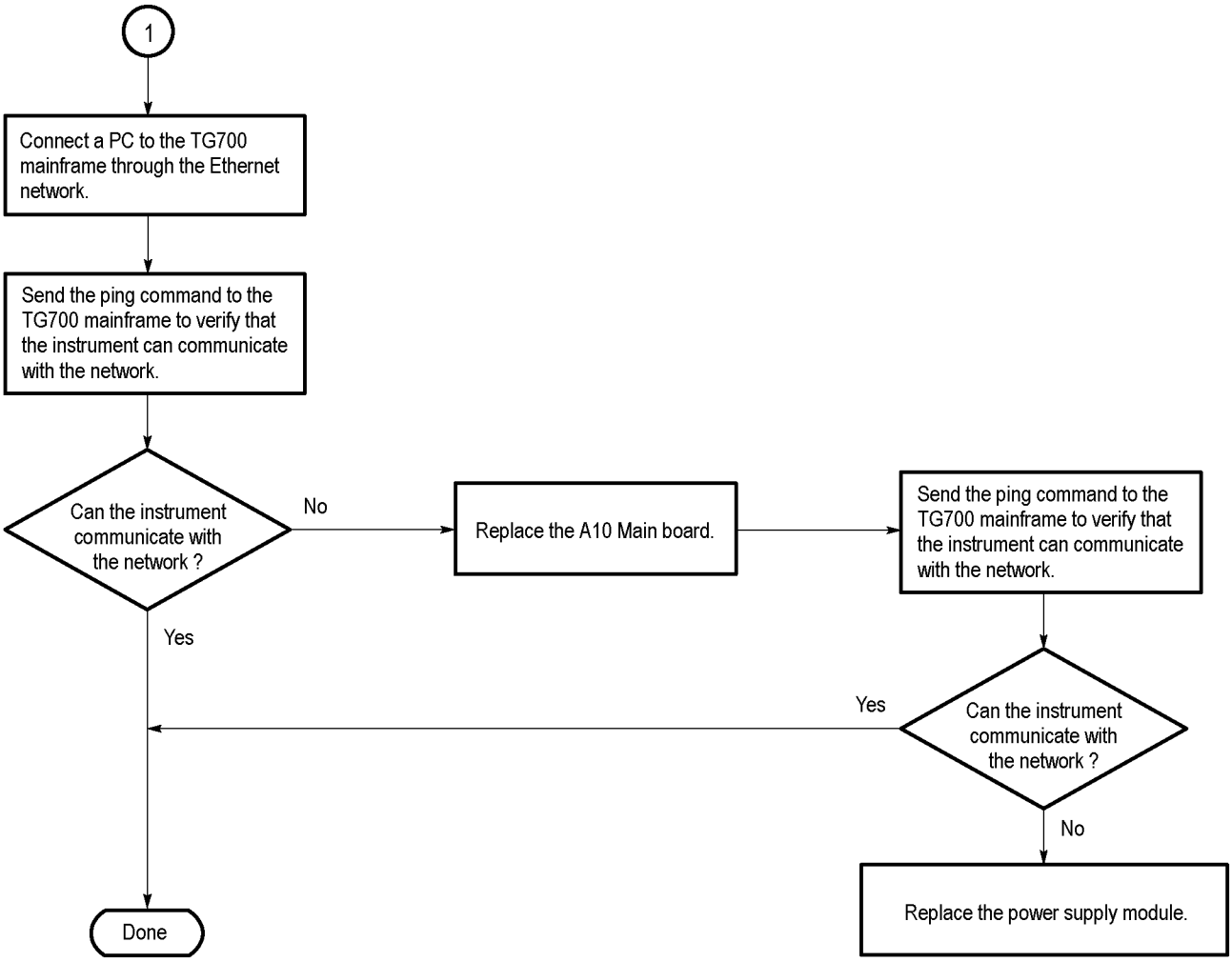

1
Connect a PC to the TG700 mainframe through the Ethernet network.
Send the ping command to the TG700 mainframe to verify that the instrument can communicate with the network.
Can the instrument communicate with the network ?
No
Replace the A10 Main board.
Send the ping command to the TG700 mainframe to verify that the instrument can communicate with the network.
Yes
Yes
Can the instrument communicate with the network ?
No
Replace the power supply module.
Done

**Figure 1-11: Troubleshooting procedure (2)**

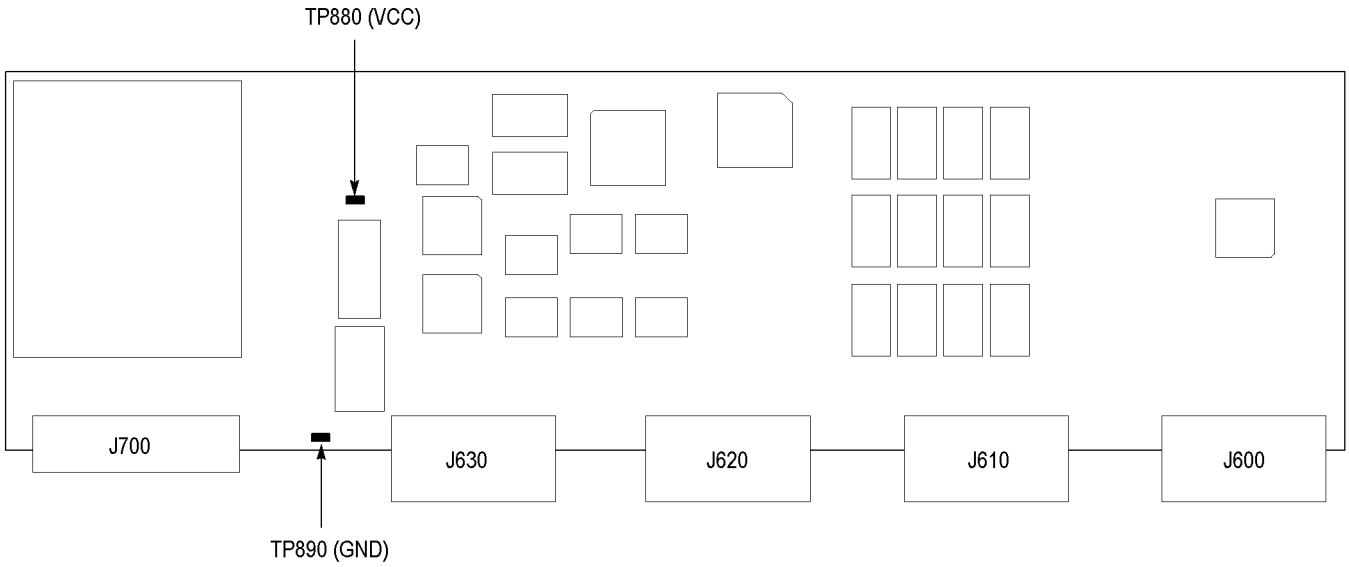



**Figure 1-12: A10 Main board (view from top)**

# TG700 Mainframe Diagrams

This section contains the following diagrams:

- Block diagram of the TG700
- Interconnect diagram of the TG700

The Block diagram shows the modules and functional blocks in the TG700. The Interconnect diagram shows how the modules in the TG700 connect together.

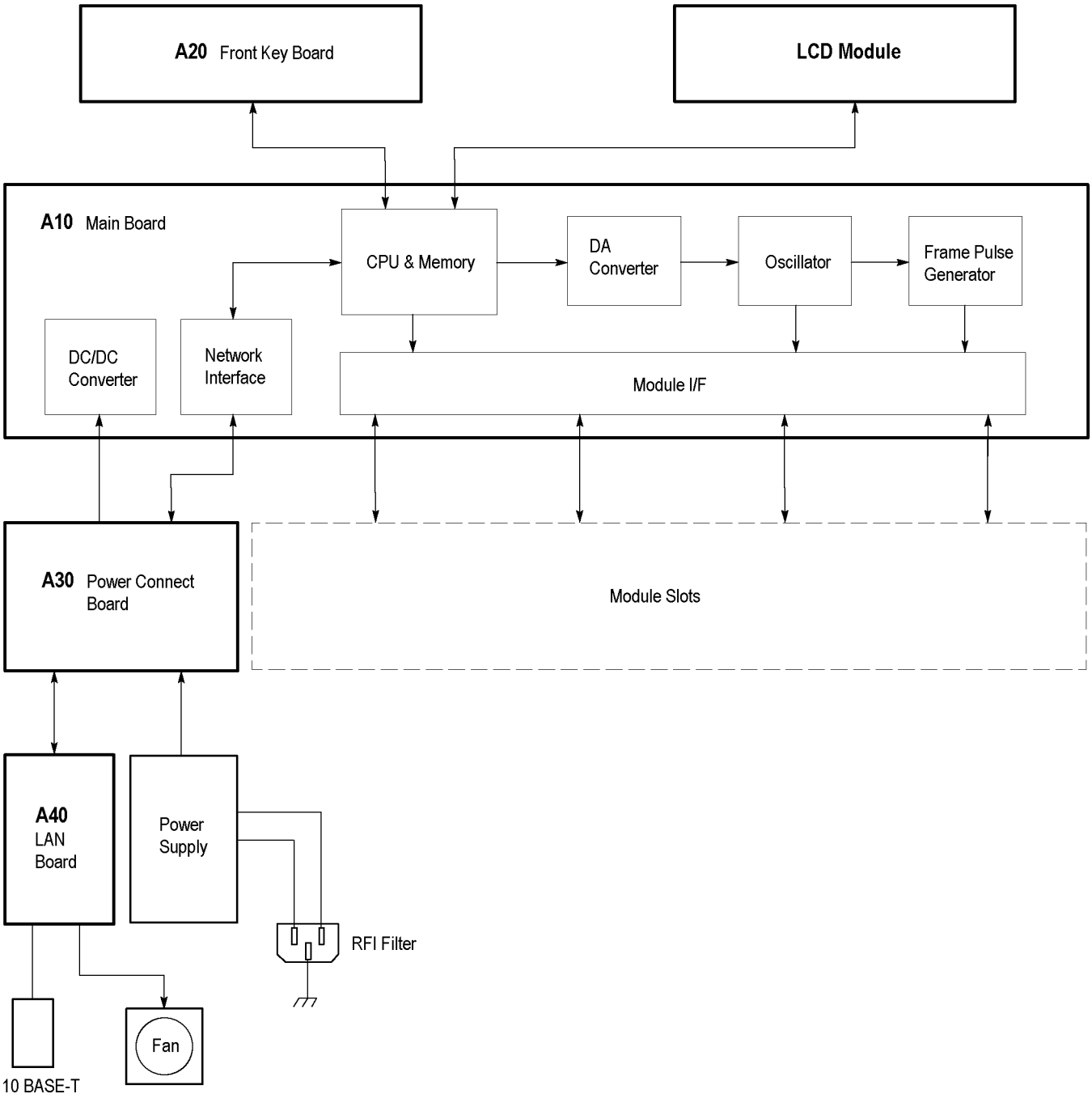



**Figure 1-13: TG700 block diagram**

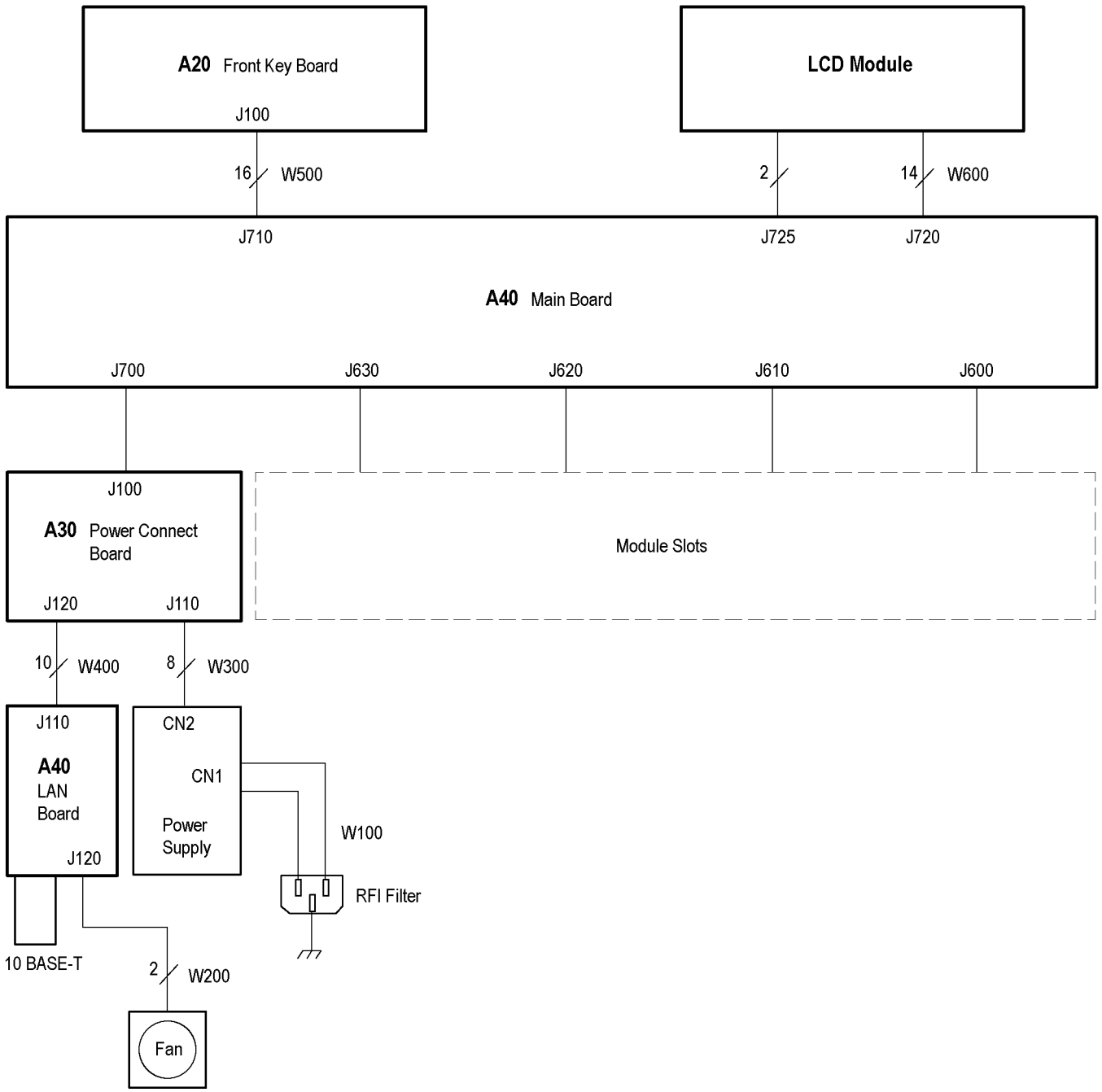



**Figure 1-14: TG700 interconnect diagram**

# TG700 Mainframe Replaceable Parts List

This section contains a list of the replaceable modules for the TG700 mainframe. Use this list to identify and order replacement parts.

## Parts Ordering Information

Replacement parts are available through your local Tektronix field office or representative.

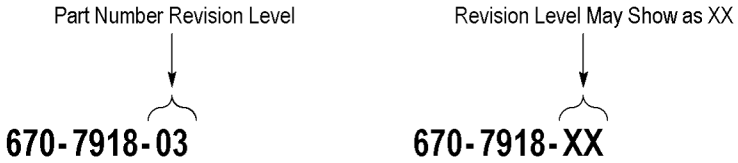
Changes to Tektronix products are sometimes made to accommodate improved components as they become available and to give you the benefit of the latest improvements. Therefore, when ordering parts, it is important to include the following information in your order.

- Part number (see Part Number Revision Level below)
- Instrument type or model number
- Instrument serial number
- Instrument modification number, if applicable

If you order a part that has been replaced with a different or improved part, your local Tektronix field office or representative will contact you concerning any change in part number.

### Part Number Revision Level

Tektronix part numbers contain two digits that show the revision level of the part. For most parts in this manual, you will find the letters XX in place of the revision level number.




When you order parts, Tektronix will provide you with the most current part for your product type, serial number, and modification (if applicable). At the time of your order, Tektronix will determine the part number revision level needed for your product, based on the information you provide.

### Module Servicing

Modules can be serviced by selecting one of the following three options. Contact your local Tektronix service center or representative for repair assistance.

**Module exchange.** In some cases you may exchange your module for a remanufactured module. These modules cost significantly less than new modules and meet the same factory specifications. For more information about the module

exchange program, call 1-800-833-9200. Outside North America, contact a Tektronix sales office or distributor; see the Tektronix Web site for a list of offices: www.tektronix.com

**Module repair and return.** You may ship your module to us for repair, after which we will return it to you.

**New modules.** You may purchase replacement modules in the same way as other replacement parts.

## Using the Replaceable Parts List

This section contains a list of the mechanical and/or electrical components that are replaceable for the TG700. Use this list to identify and order replacement parts. The following table describes each column in the parts list.

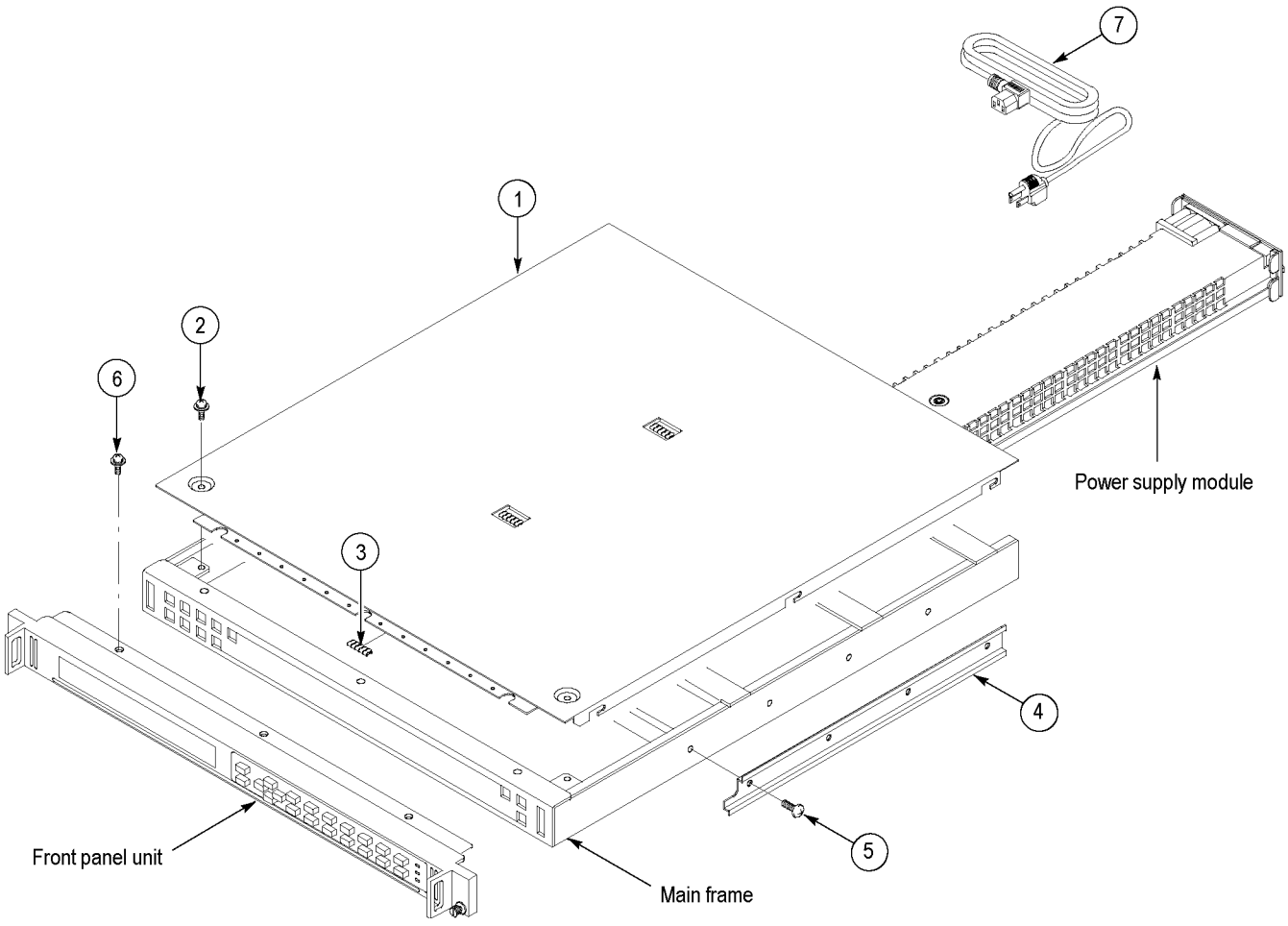
**Table 1-6: Parts list column descriptions**

| Column | Column name | Description |
|---|---|---|
| 1 | Figure & Index Number | Items in this section are referenced by figure and index numbers to the exploded view illustrations that follow. |
| 2 | Tektronix Part Number | Use this part number when ordering replacement parts from Tektronix. |
| 3 and 4 | Serial Number | Column three indicates the serial number at which the part was first effective. Column four indicates the serial number at which the part was discontinued. No entries indicates the part is good for all serial numbers. |
| 5 | Qty | This indicates the quantity of parts used. |
| 6 | Name & Description | An item name is separated from the description by a colon (:). Because of space limitations, an item name may sometimes appear as incomplete. Use the U.S. Federal Catalog handbook H6-1 for further item name identification. |

**Abbreviations** Abbreviations conform to American National Standard ANSI Y1.1-1972.

### Table 1-7: Main chassis – replaceable parts

| Fig. & index number | Tektronix part number | Serial no. effective | Serial no. discont'd | Qty | Name & description |
|---|---|---|---|---|---|
| 1-15-1 | 390-A086-03 | | | 1 | CABINET,TOP:ASSY |
| -2 | 211-A245-00 | | | 2 | SCREW,MACHINE;M3X6MM L,PNH,STL,NI PL,CROSS REC,W/KOGATAMARU&LOCK WASHER |
| -3 | 348-A128-00 | | | 15 | SHLD GASKET,ELEK:FINGER TYPE,5.1MMX6.4MM W,BE-CU [97-645-02] |
| -4 | 351-0104-03 | | | 1 | SL SECT,DWR EXT:12.625 L,W/O HARDWARESAFETY |
| -5 | 212-A041-00 | | | 8 | SCREW,MACHINE;M4X8MM L,PNH,STL,NI PL,CROSS REC,W/KOGATAMARU&LOCK WASHER |
| -6 | 211-A245-01 | | | 7 | SCREW,MACHINE;M3X6MM L,PNH,STL,NI PL,CROSS REC,W/KOGATAMARU&LOCK WASHER |
| -7 | 161-0216-00 | | | 1 | CABLE ASSY,PWR,:3,18 AWG,2.5M L,BLACK,SAFETY CONTROLLED (STANDARD ACCESSORY) |




### Figure 1-15: Main chassis

### Table 1-8: Main frame – replaceable parts

| Fig. & index number | Tektronix part number | Serial no. effective | Serial no. discont'd | Qty | Name & description |
|---|---|---|---|---|---|
| 1-16- | 116-0586-03 | | | 1 | EXCHANGE MODULE:TG700 |
| | 116-1099-03 | | | 1 | EXCHANGE MODULE:TG700-FP |
| 1-16-1 | 441-A262-00 | | | 1 | CHASSIS,MAIN:ASSY |
| -2 | 671-5802-02 | | | 1 | CIRCUIT BD ASSY:A10 MAIN,389-B031-XX WIRED |
| | 671-5803-02 | | | 1 | CIRCUIT BD ASSY:A10 MAIN,OPT,389-B031-XX WIRED |
| -3 | 211-A245-01 | | | 8 | SCREW,MACHINE:M3X6MM L,PNH,STL,N1 PL,CROSS REC,W/KOGATAMARU&LOCK WASHER |
| -4 | 348-A130-00 | | | 96 cm | GASKET,SHIELD:CONDUCTIVE URETHANE FORM STRIP,5MM WX0.5MM T,WITHOUT ADHESIVE |
| -5 | 348-A132-00 | | | 24 cm | GASKET,SHIELD:CONDUCTIVE URETHANE FORM STRIP,7MM WX1MM T, W/ADHESIVE |
| -6 | 348-A132-00 | | | 42 cm | GASKET,SHIELD:CONDUCTIVE URETHANE FORM STRIP,7MM WX1MM T, W/ADHESIVE |
| -7 | 348-A559-51 | | | 1 | MARKER,IDENT:MKD WARNING |
| -8 | 334-1378-03 | | | 1 | MARKER,IDENT:MKD SERIAL NO. |
| -9 | 348-A133-00 | | | 20 cm | GASKET,SHIELD:CONDUCTIVE URETHANE FORM STRIP,5.5MM WX13MM T, W/ADHESIVE |

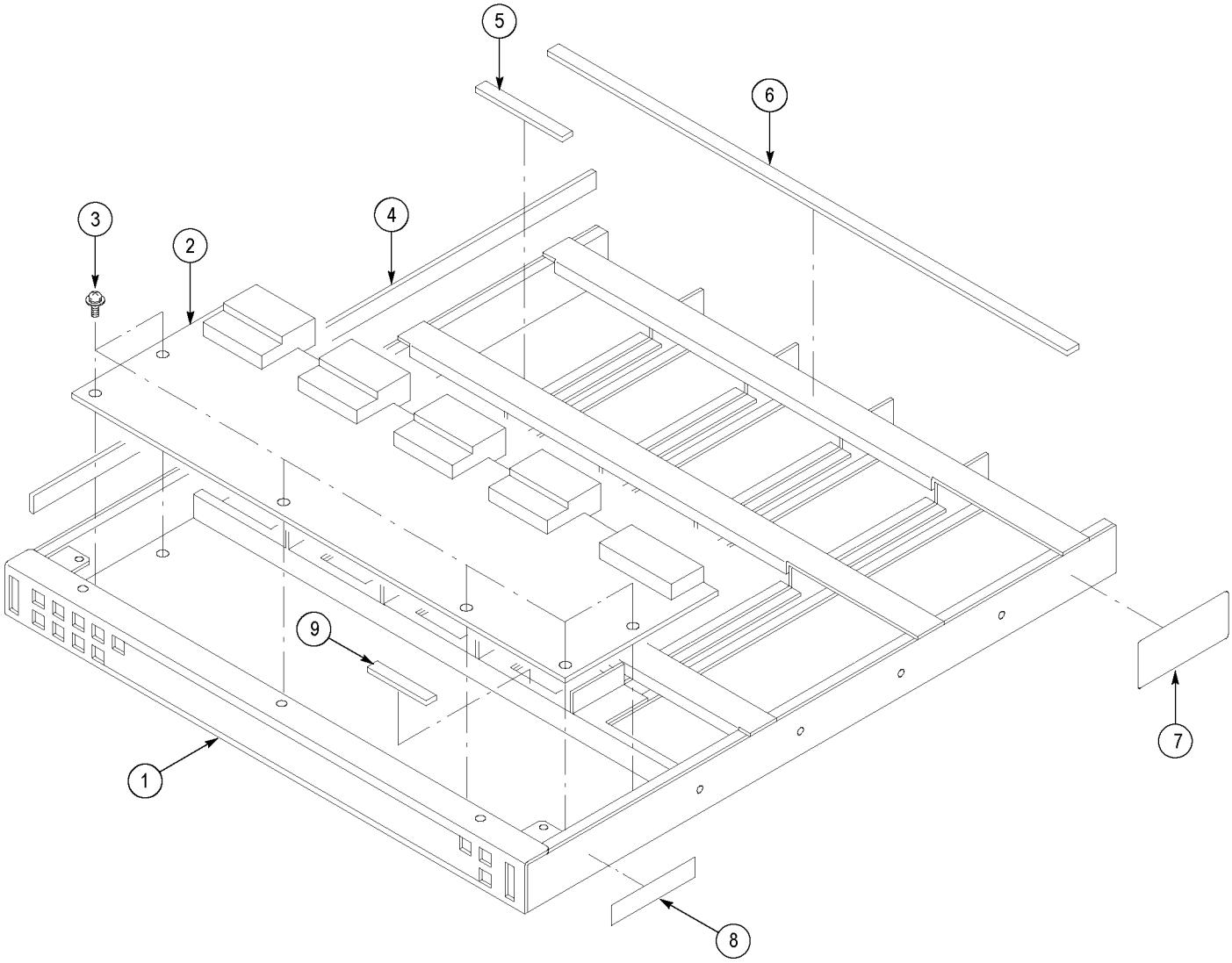



**Figure 1-16: Main frame**

### Table 1-9: Front-panel unit – replaceable parts

| Fig. & index number | Tektronix part number | Serial no. effective | Serial no. discont'd | Qty | Name & description |
|---|---|---|---|---|---|
| 1-17-1 | 426-A165-00 | | | 1 | FRAME,FRONT:ASSY |
| -2 | 119-B053-01 | | | 1 | LCD MODULE:LCD W/CONN |
| -3 | 211-A245-01 | | | 4 | SCREW,MACHINE:M3X6MM L,PNH,STL,NI PL,CROSS REC,W/KOGATAMARU & LOCK WASHER |
| -4 | 200-A513-01 | | | 1 | COVER,FRONT:PC,CONDUCTIVE COATED,TG700 |
| -5 | 378-A047-01 | | | 1 | FILTER,LCD:ACRYLIC,TG700 |
| -6 | 333-A400-01 | | | 1 | PANEL,FRONT:LEXAN,TG700 |
| -7 | 213-A245-00 | | | 1 | THUMBSCREW:10-32UNFX21.6MM L,10.3MM OD HD,STL,W/NYLON WASHER |
| -8 | 361-A174-00 | | | 1 | SPACER,8MM ODX3MM L,POLYACETATE,HIROSUGI KEIKI,CZ-503 |
| -9 | 354-A054-00 | | | 1 | RING,RETAINING:EXT TYPE-E,U/O 3.0 MM DIA GROOVE,SST [1110201-11040] |
| -10 | 260-A147-00 | | | 1 | SWITCH,RUBBER:SILICON,TG700 |
| -11 | 213-1127-00 | | | 4 | SCREW,TPG:M3X8MM L,PNH,STL,BLK ZN PL,CROSS REC [PTP3X8ZB] |
| -12 | 213-1127-00 | | | 2 | SCREW,TPG:M3X8MM L,PNH,STL,BLK ZN PL,CROSS REC [PTP3X8ZB] |
| -13 | 174-B790-00 | | | 1 | CA ASSY,SP,ELEC:16,28AWG,20CM L,FLAT |
| -14 | 174-B791-00 | | | 1 | CA ASSY,SP,ELEC:14,28AWG,15CM L,FLAT |
| -15 | 671-B082-00 | | | 1 | CIRCUIT BOARD ASSY:A20 FRONT KEY,389-B032-XX WIRED |
| -16 | 348-A120-00 | | | 33 CM | GASKET SHIELD:CONDUCTIVE URETHANE FORM,2MMX4MM,W/ADHESIVE [E02S040020] |
| -17 | 348-A132-00 | | | 8 CM | GASKET,SHIELD:CONDUCTIVE URETHANE FORM STRIP,7MMWX1MMT,W/ADHESIVE TAPE |

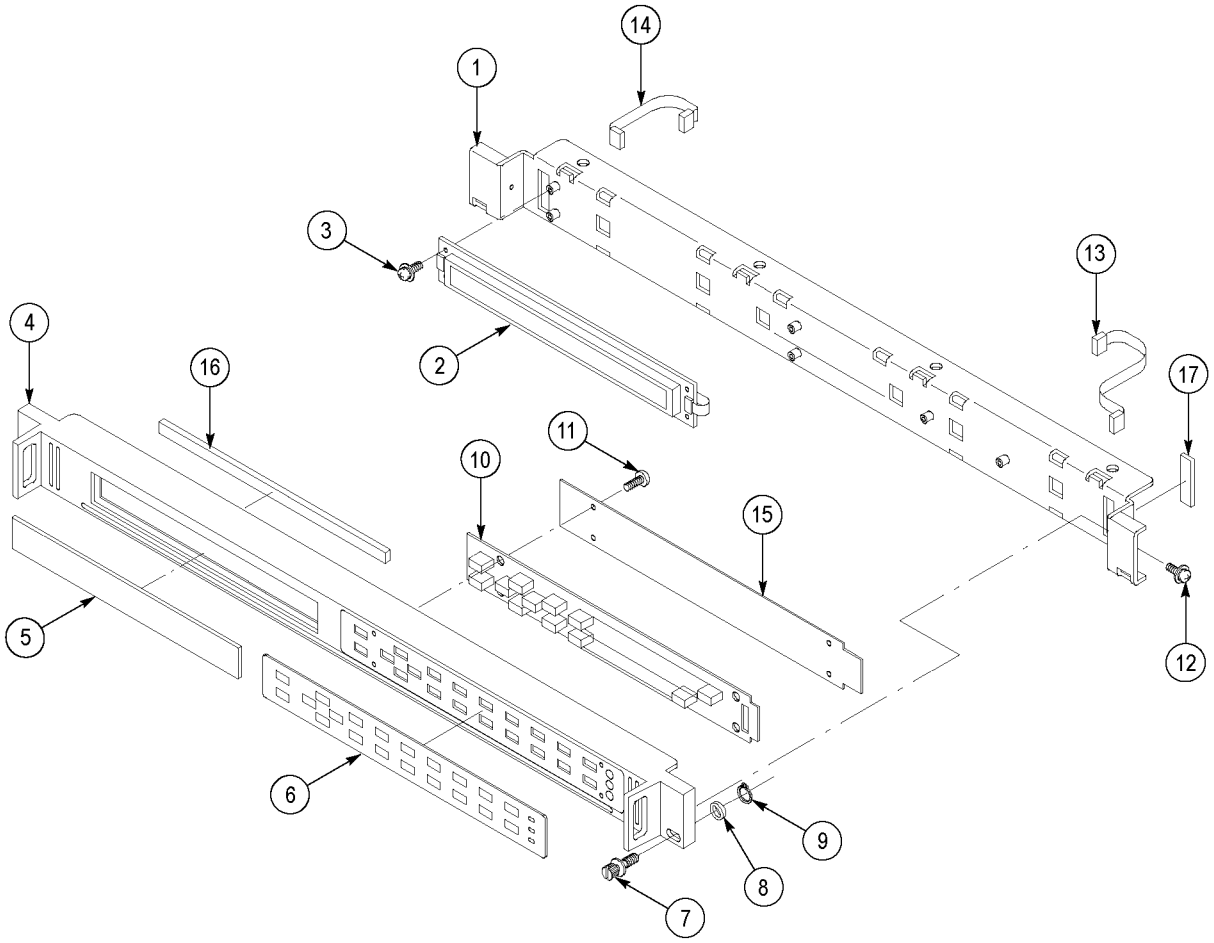



**Figure 1-17: Front-panel unit**

### Table 1-10: Power supply module – replaceable parts

| Fig. & index number | Tektronix part number | Serial no. effective | Serial no. discont'd | Qty | Name & description |
|---|---|---|---|---|---|
| 1-18- | 650-A810-00 | | | 1 | COMPONENT KIT POWER SUPPLY W/CARTON,TG700 |
| 1-18-1 | 441-A263-00 | | | 1 | CHASSIS,P/S:ASSY |
| -2 | 333-A041-00 | | | 1 | PANEL,REAR:POWER SUPPLY,AL |
| -3 | 211-A256-00 | | | 4 | SCREW,MACHINE:M3X40MM L,PNH,STL,NI PL,CROSS REC,W/KOGATAMARU & LOCK WASHER |
| -4 | 131-4131-00 | | | 1 | CONN,PLUG,ELEC:MALE W/LOCKING ADPTR,EXT MTG |
| -5 | 211-A266-00 | | | 2 | SCREW,MACHINE:M3X12MM L,PNH,STL,NI PL,CROSS REC,W/KOGATAMARU & LOCK WASHER |
| -6 | 213-1129-00 | | | 2 | SCREW,MACHINE:M2.5X11MM L,PAN HD,STL,NI PL,CROSS REC & SLOTTED [322401-05] |
| -7 | 214-4946-00 | | | 2 | SPRING,CONICAL:VXI MOUNTING SCREW,0.26 MM SUS304,5.4MML |
| -8 | 119-B143-00 | | | 1 | FILTER,RFI:3A,250VAC,0.5MA,0.150HM,50/60HZ [ZUB2203H-F] |
| -9 | 119-B059-00 | | | 1 | FAN,TUBE AXIAL:119-B055-00 W/CONN,10CML |
| -10 | 220-A172-01 | | | 1 | NUT,PLATE:POWER SUPPLY FAN,AL |
| -11 | 220-0193-00 | | | 1 | NUT,PLAIN,HEX:M4X7MM HEX,STL,ZN-C |
| -12 | 210-0008-00 | | | 1 | WASHER,LOCK:#8 INTL,0.02 THK,STL CD PL |
| -13 | 119-B054-00 | | | 1 | POWER SUPPLY:INPUT 85-264VAC,OUTPUT 5VDC,20A [LEA100F-5] |
| -14 | 342-A142-01 | | | 1 | INSULATOR,PLATE:POWER SUPPLY,PC |
| -15 | 671-B083-00 | | | 1 | CIRCUIT BOARD ASSY:A30 POWER CONNECT,389-B033-XX WIRED |
| -16 | 211-A245-01 | | | 11 | SCREW,MACHINE:M3X6MM L,PNH,STL,NI PL,CROSS REC,W/KOGATAMARU & LOCK WASHER |
| -17 | 200-A514-00 | | | 1 | COVER,TOP:POWER SUPPLY,AL |
| -18 | 174-C019-00 | | | 1 | CA ASSY,SP,ELEC:0-N 9-N,10CM L |
| -19 | 174-B789-00 | | | 1 | CA ASSY,SP,ELEC:10,28AWG,30CM L,FLAT |
| -20 | 174-B788-00 | | | 1 | CA ASSY,SP,ELEC:8,18AWG,10CM L,2-N |
| -21 | 671-B084-51 | | | 1 | CIRCUIT BOARD ASSY:A40 LAN CONNECT,389-B034-XX WIRED |
| -22 | 334-1378-03 | | | 1 | MARKER,IDENT:MKD SERIAL NO. FOR SONY/TEK |

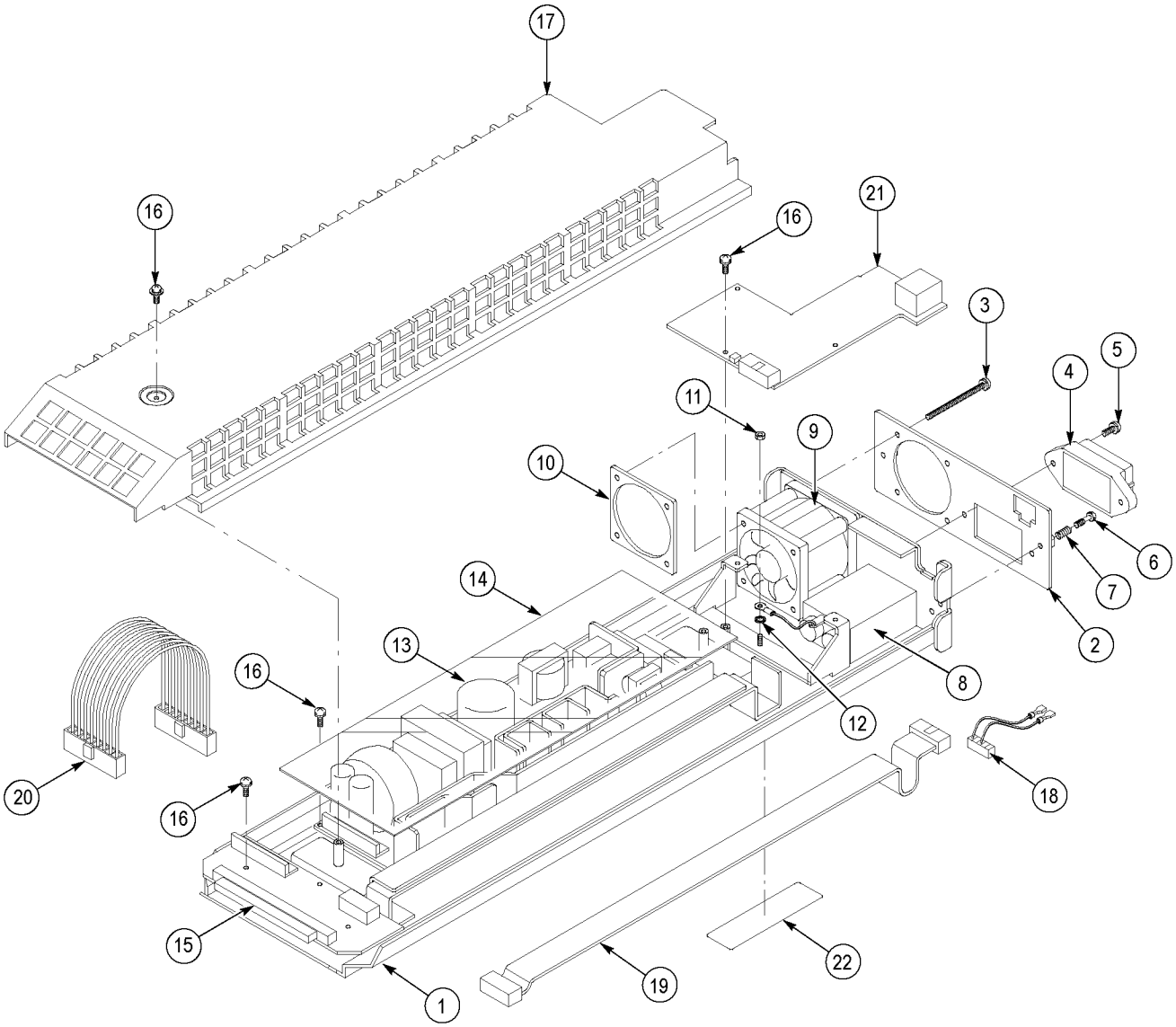



**Figure 1-18: Power supply module**

### Table 1-11: Blank panel – replaceable parts

| Fig. & index number | Tektronix part number | Serial no. effective | Serial no. discont'd | Qty | Name & description |
|---|---|---|---|---|---|
| 1-19- | 614-A021-00 | | | 1 | PANEL,BLANK ASSY TG700,W/GASKET&LOCK SCREW |
| 1-19-1 | 333-A411-00 | | | 1 | CHASSIS,MODULE BLANK:ASSY |
| -2 | 214-4946-00 | | | 2 | SPRING,CONICAL:VXI MOUNTING SCREW,0.26MM SUS304,5.4MM L |
| -3 | 213-1129-01 | | | 2 | SCREW,MACHINE:M2.5X11MM L,PAN HD,STL,NI PL,CROSS REC & SLOTTED |
| -4 | 348-A128-00 | | | 2.5 CM | SHLD GASKET,ELEC:FINGER TYPE,5.1 MM LX6.4MM W,BE-CU [97-645-05] |

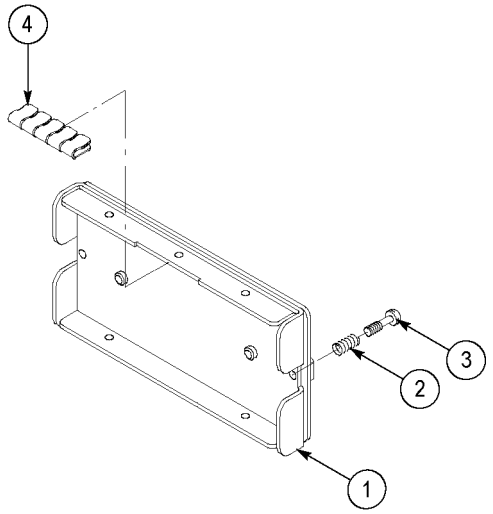



Figure 1-19: Blank panel

### Table 1-12: Standard and optional accessories for TG700 mainframe

| Component number | Tektronix part number | Serial no. effective | Serial no. discont'd | Qty | Name & description |
|---|---|---|---|---|---|
| | | | | | **STANDARD ACCESSORIES** |
| | 351-0751-XX | | | 1 | TRK SL OUT SECT:STATIONARY & INTERMEDIATE SAFETY CONTROLLED |
| | 063-3939-XX | | | 1 | KIT: SOFTWARE LIBRARY, DOCUMENTATION DVD |
| | 071-1970-XX | | | 1 | MANUAL,TECH:USERS |
| | 161-0216-00 | | | 1 | CABLE ASSY,PWR,:3,18 AWG,2.5M L,BLACK (STANDARD ONLY) |
| | | | | | **OPTIONAL ACCESSORIES** |
| | 614-A021-XX | | | 1 | BLANK PANEL |

# Removing a Module

To remove a module from the mainframe, perform the following procedure:

***CAUTION.*** *To make module removal easier, attach terminations or BNC cables to the module connectors. The connectors may be damaged if too much force is applied during module removal.*

1. Unplug the power cord from the power connector on the mainframe rear panel.
2. Attach 75 Ω terminations or BNC cables to the BNC connectors on the module to be removed. Module removal becomes easier if the terminations or cables are attached to the connectors on the left and right sides of the module.
3. Use a screwdriver with a #1 Phillips tip to loosen the two screws securing the module to the mainframe.

***CAUTION.*** *Be careful not to damage the parts and cables inside of the module when you remove the module from the mainframe.*

4. Pull the module slowly toward you while supporting the terminations or BNC cables attached to the connectors.

# AG7 Audio Generator

# AG7 Audio Generator Theory of Operation

This section describes the basic operation of the major circuit blocks in the AG7 Generator module.

### Bus Interface

This block provides the communication between the mainframe and the module circuit.

### Audio Memory

This block contains 20/24 bits audio data for all of the serial audio outputs.

### Audio Data Controller and 48 kHz Decoder

The block is a part of the FPGA. It receives audio data from the Audio Memory and encodes these data to serial audio data stream that comply with the AES/EBU standard. It also generates 48 kHz clock signal.

### Channel Buffers (1+2, 3+4, 5+6, 7+8, and Silence)

These blocks receive the digital audio data from the FPGA and set the output amplitude to the specified level.

### 48 kHz Clock Buffer

The block outputs 48 kHz clock signal. The output level of the clock signal can be set to either a CMOS compatible level or 1 V. This feature is available through jumper J452 on the circuit board.

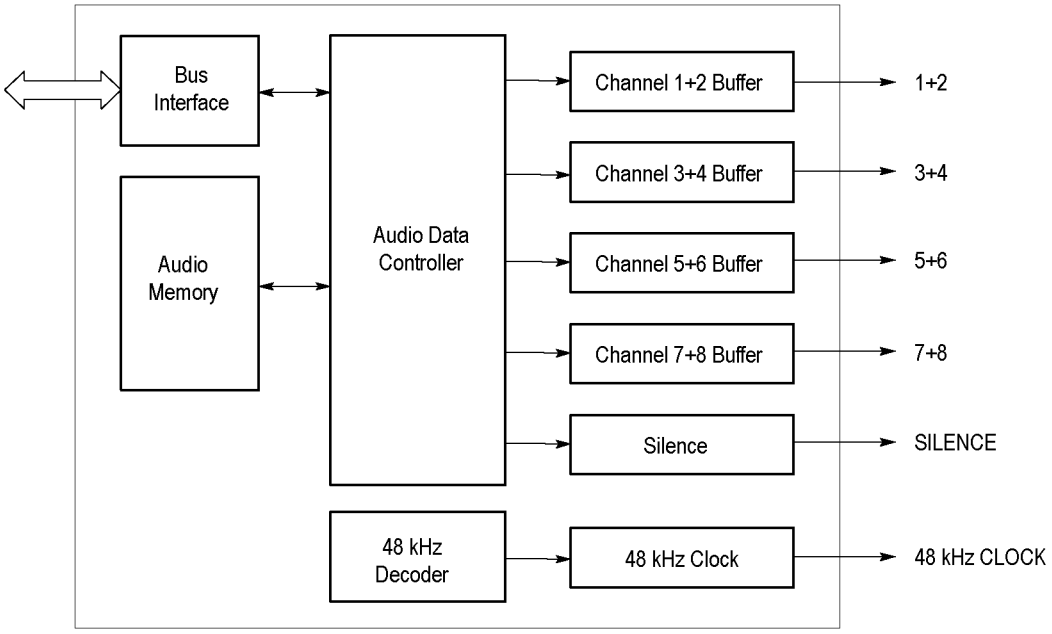



**Figure 2-1: Simplified block diagram of the AG7 Generator module**

# AG7 Audio Generator Maintenance

This section contains instructions and procedures for maintaining the AG7 Generator module. Before following these procedures, read *Maintenance for Generators and Modules*. (See page xix.).

The following information can be found in this section:

- Removal and Replacement (See page 2-3.)
- Troubleshooting (See page 2-5.)

If the instrument does not function properly, troubleshooting and corrective measures should be taken immediately to prevent additional problems.

***NOTE.*** *Contact your local Tektronix representative for information on where to return your instrument if it requires repair during the warranty period.*

# AG7 Audio Generator Removal and Replacement

This section contains the instructions on how you can remove and replace the customer replaceable parts of the AG7 Generator module.

## Tools Required

The following tools are required to perform the removal and replacement procedures:

**Table 2-1: Required tools for removal and replacement of AG7 Audio Generator**

| Name | Description | Tektronix part number |
|---|---|---|
| Screwdriver handle | Accepts Phillips-driver bits | |
| #1 Phillips tip | Phillips-driver bit for #1 size screw heads | |
| #2 Phillips tip | Phillips-driver bit for #2 size screw heads | |
| Nut driver, 11 mm | Special nut driver for removing the BNC connectors of the AG7 module | 003-A042-00 |

## Replacing the Rear-Panel Connectors and Chassis

It is usually not necessary to replace the rear-panel connectors or chassis. However, if a connector or chassis becomes damaged, you can replace it.

### Replacing the Rear-Panel Connectors

Perform the following procedure to replace the rear-panel connector:

1. Use the *Removing a Module* section to remove the AG7 Generator module from the mainframe. (See page 1-41, *Removing a Module*.)
2. Disconnect these cables:
   - The cable from J400 at 1+2 connector.
   - The cable from J410 at 3+4 connector.
   - The cable from J420 at 5+6 connector.
   - The cable from J430 at 7+8 connector.
   - The cable from J440 at SILENCE connector.
   - The cable from J450 at 48 kHz CLOCK connector.
3. Use a screwdriver with a #2 Phillips tip to remove the four screws securing the AG7 circuit board to the chassis.

4. Lift the circuit board up and away from chassis, and then place it on a static free surface.
5. Use the 11 mm nut driver to remove the nut securing the damaged connector to the chassis. Pull the connector away.
6. Perform steps 2 through 5 in reverse order to replace the connector.

## Replacing the Chassis

Perform the following procedure to replace the chassis:

1. Perform steps 1 through 4 in *Replacing the Rear-Panel Connectors*. (See page 2-3.)
2. Use the 11 mm nut driver to remove the nuts from each of the rear-panel connectors.
3. Set the replacement chassis on a firm, flat, static-free work surface.
4. Apply the rear panel to the chassis, and then install all the connectors to the chassis.
5. Carefully place the AG7 circuit board in place on the chassis.
6. Use a screwdriver with a #2 Phillips tip to install the four screws securing the circuit board to the chassis.
7. Reconnect all the cables to the rear-panel connectors.

# AG7 Audio Generator Troubleshooting

This section contains instructions and procedures for troubleshooting the AG7 Generator module. These procedures will help you decide whether it is necessary to replace your module.

If the TG700 mainframe does not boot up or if the display is not working, refer to the *TG700 Mainframe Troubleshooting* section in this manual. (See page 1-24, *TG700 Mainframe Troubleshooting*.)

## Equipment Required

The equipment listed in the following table is required for troubleshooting.

**Table 2-2: Equipment required for AG7 Audio Generator troubleshooting**

| Equipment description | Minimum requirements/example |
|---|---|
| Screwdriver handle | Accept Phillips-driver bits |
| #1 Phillips tip | Phillips-driver bit for #1 size screw heads |
| TG700 mainframe | A TG700 mainframe that is functioning correctly |

## Backing Up the Instrument Settings

Before you begin the trouble shooting procedures, create a preset to save your instrument settings as follows:

1. Press the **MODULE** button until the mainframe main menu (TG700: PRESET) appears.
2. Press the **ENTER** button to access the PRESET submenu.
3. Press the up (▲) or down (▼) arrow button to select **SAVE**.
4. Press the left (◄) or right (►) arrow button to select a preset number to save instrument settings.
5. Press the **ENTER** button to save the current instrument settings to the new preset.

After the problem is solved, recall the preset you created.

## Troubleshooting Trees

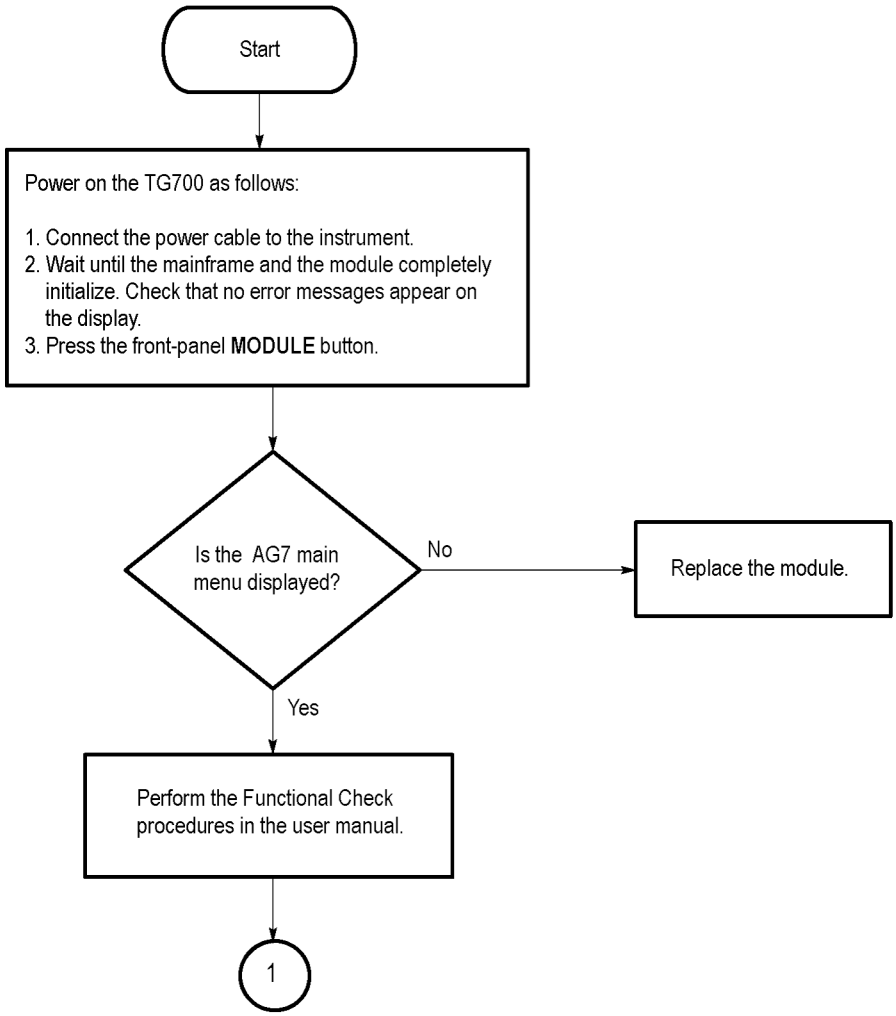

Start
Power on the TG700 as follows:
1. Connect the power cable to the instrument.
2. Wait until the mainframe and the module completely initialize. Check that no error messages appear on the display.
3. Press the front-panel MODULE button.
Is the AG7 main menu displayed?
No
Replace the module.
Yes
Perform the Functional Check procedures in the user manual.
1

**Figure 2-2: Troubleshooting procedure (1)**

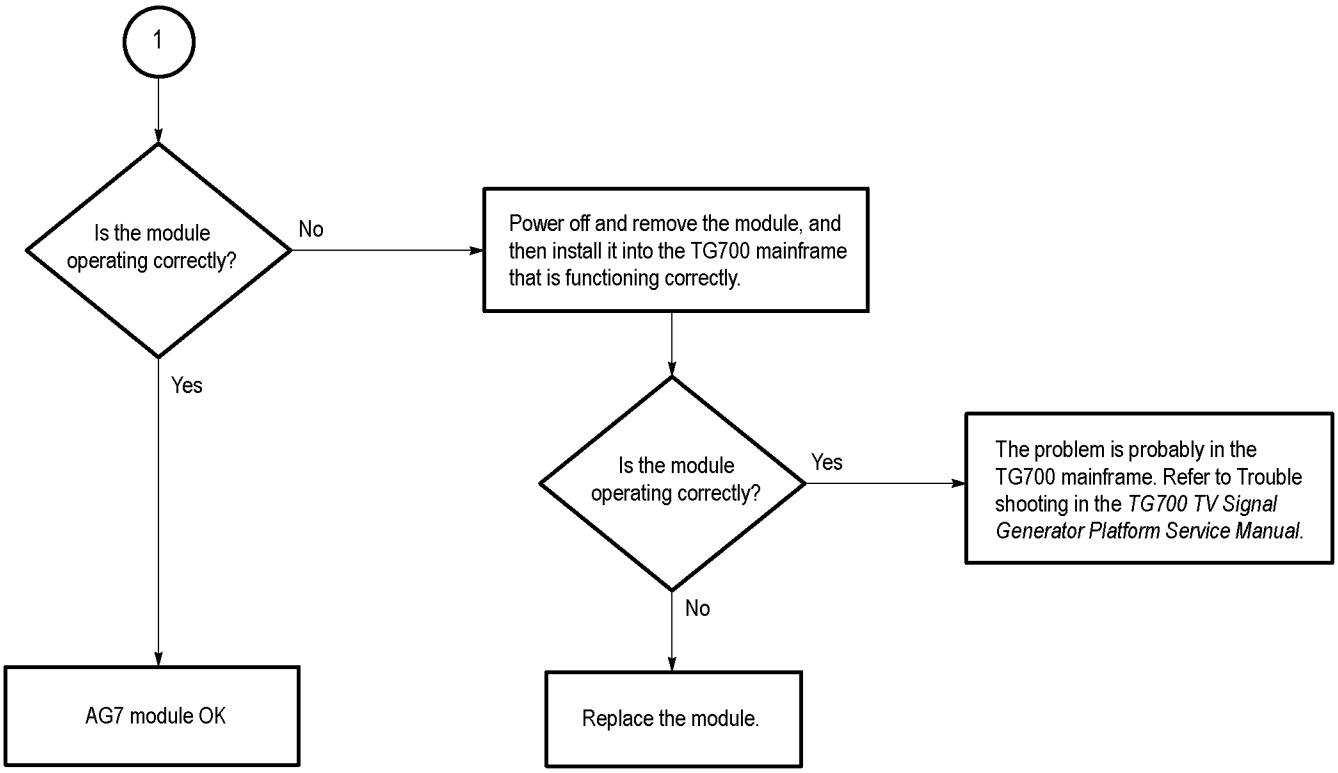

1
Is the module operating correctly?
No
Power off and remove the module, and then install it into the TG700 mainframe that is functioning correctly.
Yes
Is the module operating correctly?
Yes
The problem is probably in the TG700 mainframe. Refer to Trouble shooting in the TG700 TV Signal Generator Platform Service Manual.
No
AG7 module OK
Replace the module.

**Figure 2-3: Troubleshooting procedure (2)**

# AG7 Audio Generator Diagram

The following figure shows the AG7 Generator module and how it interconnects with the TG700 TV Signal Generator Platform.

Diagrams showing mainframe component interconnections, such as power supply and oscillator, can be found in the *TG700 Diagram* section of this manual. (See page 1-28, *TG700 Mainframe Diagrams*.)

A block diagram of the AG7 Generator module is located in the *AG7 Theory of Operation* section. (See page 2-1.)

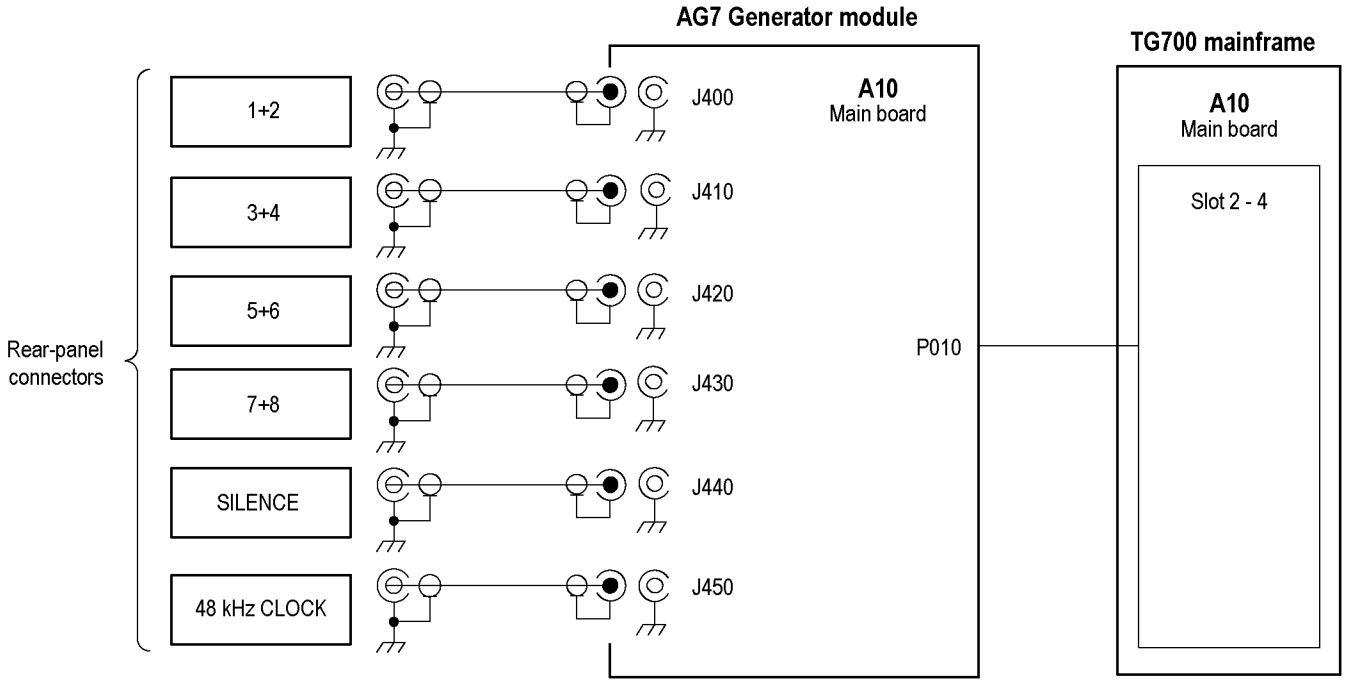



**Figure 2-4: AG7 Generator module connections**

# AG7 Audio Generator Replaceable Parts List

This section contains a list of the replaceable modules for the AG7 Generator module. Use this list to identify and order replacement parts. For parts ordering or servicing information, see *Parts Ordering Information* or *Module Servicing* in the *TG700 Mainframe Replaceable Parts List* section of this manual. (See page 1-31, *TG700 Mainframe Replaceable Parts List*.)

## Abbreviations

Abbreviations conform to American National Standard ANSI Y1.1-1972.

### Table 2-3: AG7 Generator module – replaceable parts

| Fig. & index number | Tektronix part number | Serial no. effective | Serial no. discont'd | Qty | Name & description |
|---|---|---|---|---|---|
| 2-5- | 116-A001-01 | | | 1 | EXCHANGE MODULE: AG7 |
| | 116-A001-02 | | | 1 | EXCHANGE MODULE: AG7 |
| | 116-A001-03 | | | 1 | EXCHANGE MODULE: AG7 |
| | 116-A001-04 | | | 1 | EXCHANGE MODULE: AG7 |
| | 116-A001-05 | | | 1 | EXCHANGE MODULE: AG7 |
| -1 | 441-A267-03 | | | 1 | CHASSIS,MODULE AG7: ASSY |
| -2 | 333-A404-00 | | | 1 | PANEL,REAR:AG7,AL |
| -3 | 214-4946-00 | | 116-A001-03 | 2 | SPRING,CONICAL:VXI MOUNTING SCREW,0.26 MM SUS304,5.4 MML |
| | 214-4762-00 | 116-A001-04 | | 2 | SPRING,CONICAL |
| -4 | 213-1129-01 | | 116-A001-03 | 2 | SCREW,MACHINE:M2.5X11MM L,PAN HD,STL,N1 PL,CROSS REC & SLOTTED |
| | 211-0911-00 | 116-A001-04 | | 2 | SCREW,MACHINE; M2.5,PITCH 0.45MM,LENGTH 11MM,HEAD DIA 5MM,HEAD HEIGHT 2MM,BRIGHT NICKEL FINISH STEEL,SLOTTED PHILLIPS |
| -5 | 348-A128-00 | | | 2.5 CM | SHLD GASKET,ELEK:FINGER TYPE,5.1MM LX6.4MM W,BE-CU [97-645-02] |
| -6 | 131-6383-00 | | 116-A001-03 | 6 | CONN,RF JACK:BNC,50OHM,FEMALE,STR,SNAP IN/PNL MTG,12.5MM MLG [MCF3] |
| | 131-1315-01 | 116-A001-04 | 116-A001-04 | 6 | CONN,RF,JACK; BNC,PNL,50 OHM, FEMALE, STR, PELTOLA/PNL MNT,SILVER ALLOY,0.576 MLG X 0.366 TERMN,0.375-32 THD,D-FLAT<br>**Attached Parts**<br>210-0012-00 STAR WASHER<br>220-0495-00 NUT |
| | 131-8257-00 | 116-A001-05 | | 6 | CONNECTOR, PANEL MOUNT; BNC TO MCX |
| -7 | 211-A245-01 | | | 4 | SCREW,MACHINE:M3X6MM L,PNH,STL,NI PL,CROSS REC,W/KOGATAMARU&LOCK WASHER |
| -8 | 174-A278-00 | | 116-A001-03 | 6 | CA ASSY,RF:75 OHM COAX,120MM L,BLACK [QQB-0120-0] |
| | 174-5660-00 | 116-A001-04 | 116-A001-04 | 6 | CA ASSY,RF; 50 OHM COAX,6.0INCH LENGTH,PELTOLA TO RA-MCX,;AG7 |
| | 174-5660-01 | 116-A001-05 | | 6 | CA ASSY,RF; 50 OHM COAX,6.0INCH LENGTH,MCX TO RA-MCX,;AG7 |
| -9 | 334-1378-03 | | | 1 | MARKER,IDENT:MKD SERIAL NO. |

| | | |
|---|---|---|
| **STANDARD ACCESSORIES** | | |
| 075-0986-XX | 1 | MANUAL,TECH:MODULE INSTALLATION INSTRUCTIONS |
| 063-3939-XX | 1 | KIT: SOFTWARE LIBRARY, DOCUMENTATION DVD |
| **OPTIONAL ACCESSORIES** | | |
| 003-A042-00 | 1 | NUTDRIVER,BOX:11MM HEX,BNC RETAINING NUT, MODIFIED 14.5MM |

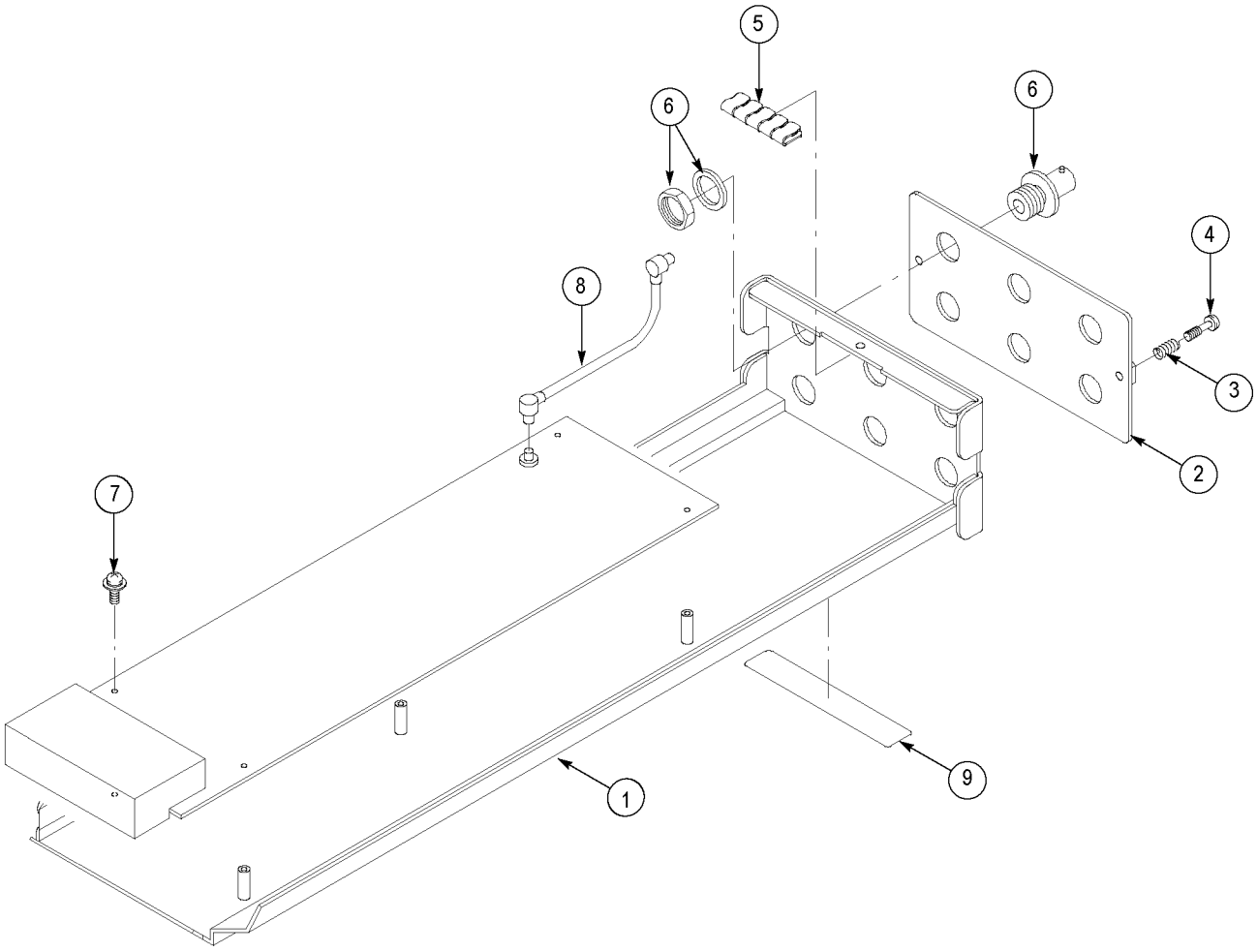



**Figure 2-5: AG7 Generator module exploded view**

# AGL7 Analog Genlock Module

# AGL7 Analog Genlock Module Theory of Operation

This section describes the basic operation of the major circuit blocks in the AGL7 Genlock module.

## Analog Genlock

The Analog Genlock consists of the following blocks.

**Bus Interface** This block provides the communication between the mainframe and the module circuit.

**Amp & Restorer** This block consists of amplifiers to adjust the amplitude of the signal from REF or CW input and restorer to recover the DC component of the signal.

**Sync Separator** The sync separator separates the sync signals such as H sync, V sync, or composite sync from the conditioned REF signal if the signal contains the sync.

**A/D Converter** The A/D converter digitizes the analog input signal to 10 bits digital data for genlock operation. This data is read by the CPU in the mainframe and used to control the master oscillator frequency.

**Genlock Controller** This block controls the A/D converter, memory, and sync separator to obtain correct digital data.

## Black Burst Generator

The Black Burst Generator consists of the following blocks:

**Black Burst Generator** This block generates NTSC or PAL black burst digital data.

**Trilevel Sync Generator** This block generates trilevel sync digital data.

**D/A Converter & Amp** This block consists of a D/A converter, two amplifiers, and a filter. It converts the digital data from the black burst generator or trilevel sync generator to an analog signal and reconstructs the signal for output. The "D/A Converter & Amp 3" also has a wide bandwidth filter for the HDTV trilevel sync signal.

**Word Clock Generator** This block generates a 48 kHz word clock signal.

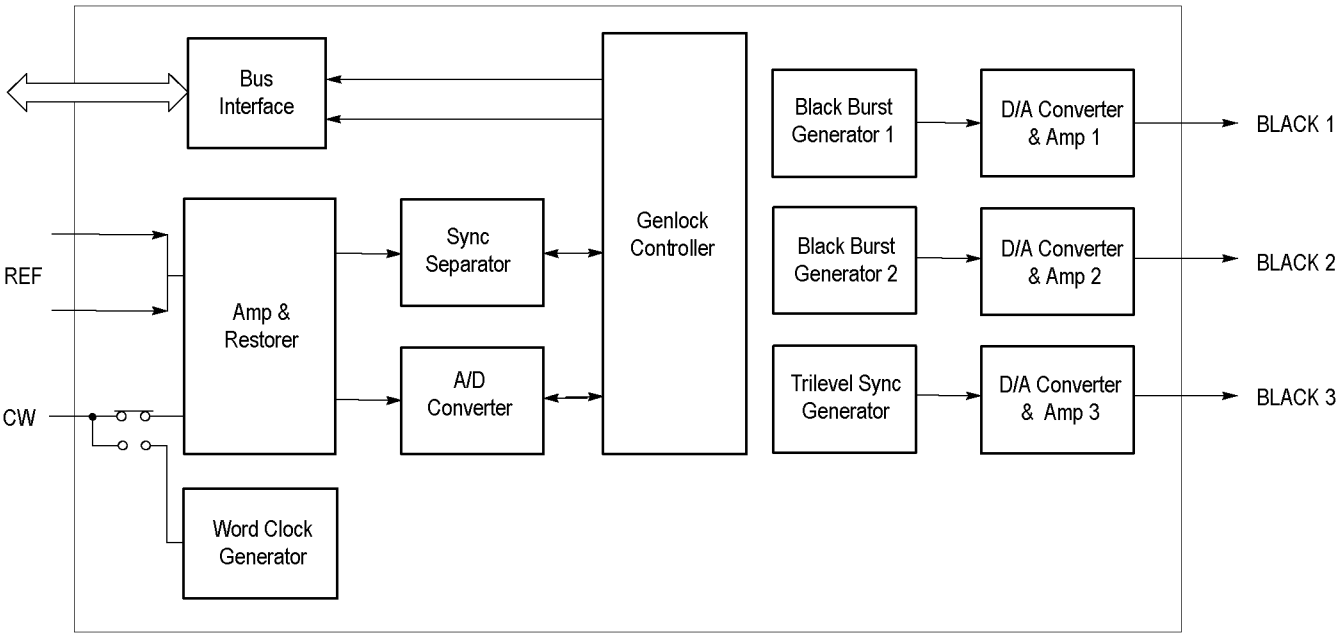



**Figure 3-1: Simplified block diagram of the AGL7 Genlock module**

# AGL7 Analog Genlock Adjustment Procedures

This section contains information needed to adjust the AGL7 Genlock module.

Adjustments in the AGL7 Genlock module are for the output offset, output gain, and clock timing.

## Requirements for Adjustment

Before doing the adjustment, note the following requirements.

### Personnel

This procedure is only to be performed by trained service technicians.

### Warm-Up Period

The AGL7 Genlock module requires a 20 minute warm-up time in a +20 °C to +30 °C environment before it is adjusted. Adjustments done before the operating temperature has stabilized may cause errors in performance.

### Access

When adjusting the output offset, output gain, and clock timing, you need to remove the top cover of the TG700 mainframe. (See page 1-15, *Top Cover*.)

## Equipment Required

The following table lists the equipment required to adjust the output offset, output gain, and clock timing.

**Table 3-1: Equipment required for AGL7 adjustment procedures**

| Item | No. | Minimum requirement | Recommended equipment |
|---|---|---|---|
| TV signal generator platform | 1 | | Tektronix TG700 |
| Digital multimeter | 1 | 5 1/2 digits | FLUKE 8842A |
| Oscilloscope | 1 | Bandwidth: 500 MHz or higher | Tektronix TDS754D with two P6139A probes |
| 75 Ω BNC cable | 1 | Length: 42 inches | Tektronix part number 012-0074-00 |
| 75 Ω coaxial terminator | 1 | | Tektronix part number 011-0102-03 |
| BNC T connector | 1 | | Tektronix part number 103-0030-00 |
| BNC female to dual banana adapter | 1 | | Tektronix part number 103-0090-00 |

## Output Offset and Gain Adjustment

### Preparation

To perform the output offset and gain adjustment, you must first remove the top cover of the TG700 mainframe. (See page 1-15, *Top Cover*.)

After you have removed the top cover, find the variable resistors on the AGL7 circuit board. See the following figure.

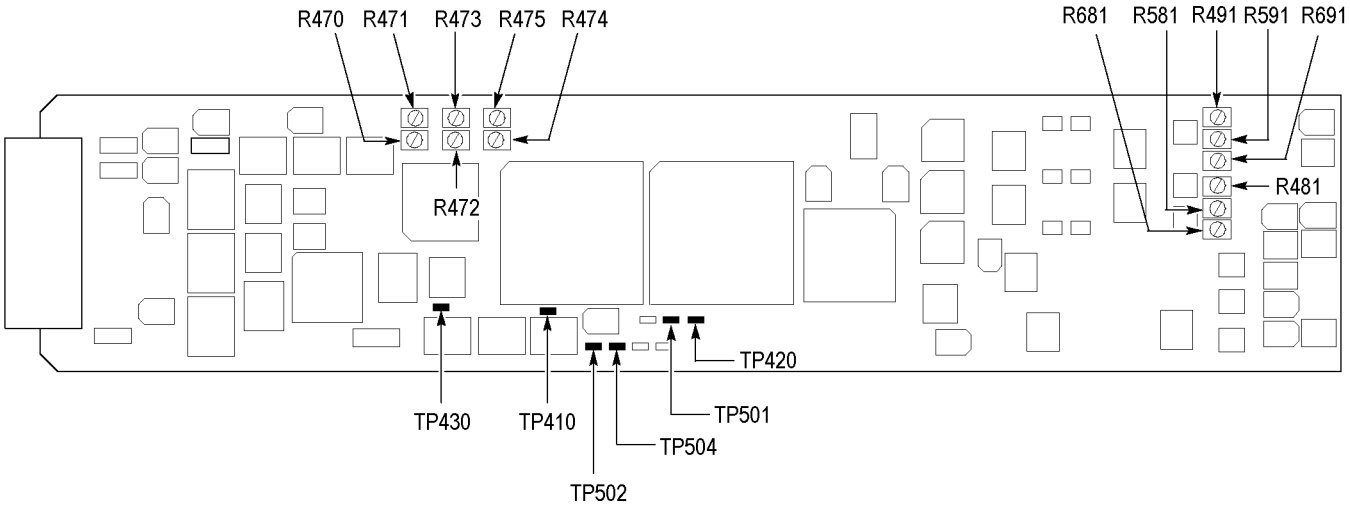



**Figure 3-2: AGL7 circuit board view**

### Procedure

***WARNING.*** *To avoid serious injury, do not touch exposed connectors or components when operating the TG700 mainframe with the top cover removed. Dangerous potentials exist at several points within the TG700 mainframe.*

1. Use the 75 Ω BNC cable, BNC T connector, 75 Ω coaxial terminator, and BNC female-to-dual banana adapter to connect the BLACK 1 connector on the AGL7 Genlock module to the INPUT connector on the digital multimeter as shown. (See Figure 3-3.)

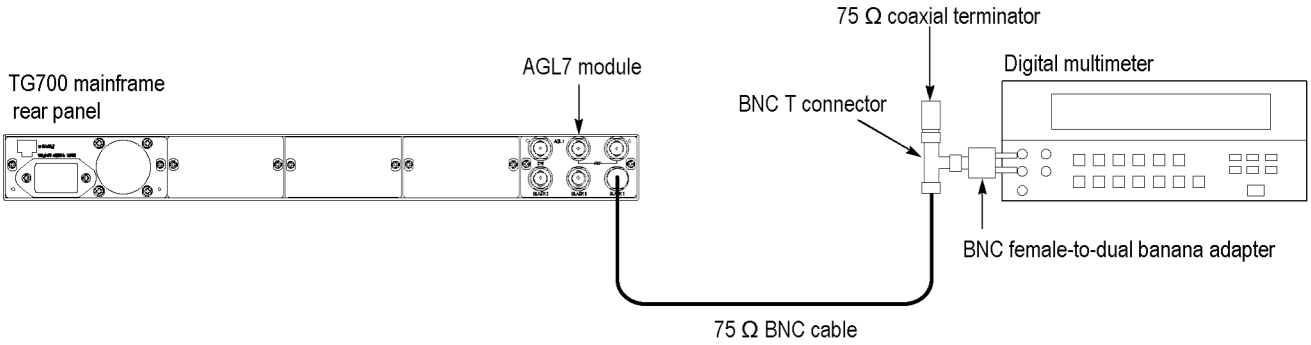



**Figure 3-3: Equipment connection for adjusting the output offset and gain**

2. Press and hold the **MODULE**, **FORMAT**, and **FRONT PANEL ENABLE** buttons simultaneously until **TG700 Preset** is displayed, then release the **MODULE** and **FORMAT** buttons to restart the instrument in Factory mode.
3. Select the DAC Offset (0V DC) calibration signal for BLACK 1 through BLACK 3 as follows:
   a. Press the **MODULE** button to display the **AGL7** main menu.
   b. Press the up (▲) or down (▼) arrow button to select **SELECT OUTPUT**.
   c. Press the left (◄) or right (►) arrow button to select **BLACK 1**, and then press the **ENTER** button.
   d. Press the left (◄) or right (►) arrow button to select **CAL**, and then press the **ENTER** button.
   e. Press the left (◄) or right (►) arrow button to select **DAC Offset (0V DC)**, and then press the **ENTER** button.
   f. Press the **CANCEL** button twice.
   g. Repeat parts c through f of this step to select the calibration signal for BLACK 2.
   h. Press the left (◄) or right (►) arrow button to select **BLACK 3**, and then press the **ENTER** button.
   i. Press the left (◄) or right (►) arrow button to select **Black Burst (Same as BLACK2)**, and then press the **ENTER** button.
   j. Press the **CANCEL** button to return the AGL7 main menu.
4. Locate variable resistor R691 on the AGL7 circuit board. (See Figure 3-2.)
5. Adjust R691 so that the output offset is 0 V ±1 mV.
6. Move the BNC cable connection from the BLACK 1 connector to the BLACK 2 connector on the AGL7 Genlock module.
7. Locate variable resistor R491 on the AGL7 circuit board. (See Figure 3-2.)

8. Adjust R491 so that the output offset is 0 V ±1 mV.
9. Move the BNC cable from the BLACK 2 connector to the BLACK 3 connector on the AGL7 Genlock module.
10. Locate variable resistor R591 on the AGL7 circuit board. (See Figure 3-2.)
11. Adjust R591 so that the output offset is 0 V ±1 mV.
12. Select the DAC Gain (1.000V DC) calibration signal for BLACK 1 through BLACK 3 as follows:
    a. Press the left (◄) or right (►) arrow button to select **BLACK 1**, and then press the **ENTER** button.
    b. Press the left (◄) or right (►) arrow button to select **CAL**, and then press the **ENTER** button.
    c. Press the left (◄) or right (►) arrow button to select **DAC Gain (1.000V DC)**, and then press the **ENTER** button.
    d. Press the **CANCEL** button twice to return the AGL7 main menu.
    e. Repeat parts a through d of this step to select the calibration signal for BLACK 2. BLACK 3 uses the previous setting (same as BLACK 2).
13. Locate variable resistor R681 on the AGL7 circuit board. (See Figure 3-2.)
14. Adjust R681 so that the output gain is 1 V ±1 mV.
15. Move the BNC cable from the BLACK 1 connector to the BLACK 2 connector on the AGL7 Genlock module.
16. Locate variable resistor R481 on the AGL7 circuit board. (See Figure 3-2.)
17. Adjust R481 so that the output gain is 1 V ±1 mV.
18. Move the BNC cable from the BLACK 2 connector to the BLACK 3 connector on the AGL7 Genlock module.
19. Locate variable resistor R581 on the AGL7 circuit board. (See Figure 3-2.)
20. Adjust R581 so that the output gain is 1 V ±1 mV.

## Clock Timing Adjustment (Board Number 671-B089-XX and 671-B279-00 Only)

### Preparation

To perform the clock timing adjustment, you must first remove the top cover of the TG700 mainframe. (See page 1-15, *Top Cover*.)

After you have removed the top cover, find the variable resistors on the AGL7 circuit board. (See Figure 3-2.)

### Procedure

***WARNING.*** *To avoid serious injury, do not touch exposed connectors or components when operating the TG700 mainframe with the top cover removed. Dangerous potentials exist at several points within the TG700 mainframe.*

1. Select the NTSC **Black Burst** signal for BLACK 1 and BLACK 2 and **1080/59.94i** signal for BLACK 3 as follows:
   - **a.** Press the left (◄) or right (►) arrow button to select **BLACK 1**, and then press the **ENTER** button.
   - **b.** Press the left (◄) or right (►) arrow button to select **NTSC**, and then press the **ENTER** button.
   - **c.** Press the left (◄) or right (►) arrow button to select **Black Burst**, and then press the **ENTER** button.
   - **d.** Press the **CANCEL** button twice to return the AGL7 main menu.
   - **e.** Repeat parts a through d of this step to select the NTSC Black Burst signal for BLACK 2.
   - **f.** Press the left (◄) or right (►) arrow button to select **BLACK 3**, and then press the **ENTER** button.
   - **g.** Press the left (◄) or right (►) arrow button to select **1080/59.94i**, and then press the **ENTER** button.
   - **h.** Press the **CANCEL** button to return the AGL7 main menu.

2. Set the horizontal fine timing for BLACK 1 through BLACK 3 to 0.00 ns as follows:

   a. Press the up (▲) or down (▼) arrow button to select **GENLOCK** and then press the **ENTER** button.

   b. Press the left (◄) or right (►) arrow button to select **INTERNAL**, and then press the **ENTER** button.

   c. Press the **CANCEL** button to return the AGL7 main menu.

   d. Press the up (▲) or down (▼) arrow button to select **SELECT OUTPUT**.

   e. Press the left (◄) or right (►) arrow button to select **BLACK 1**, and then press the **ENTER** button.

   f. Press the up (▲) or down (▼) arrow button to select **TIMING**, and then press the **ENTER** button.

   g. Press the up (▲) or down (▼) arrow button to select **Horizontal Fine**, and then press the left (◄) or right (►) arrow button to set the timing to 0.00 ns.

   h. Press the **CANCEL** button twice to return the AGL7 main menu.

   i. Repeat parts e through h of this step to set the horizontal fine timing for BLACK 2 and BLACK 3 to 0.00 ns.

3. Attach the two P6139A probes to the oscilloscope CH1 and CH2 inputs.

4. Locate test points TP410, TP420, TP430, TP501, TP502, and TP504 on the AGL7 circuit board. (See Figure 3-2.)

5. Locate variable resistors R470, R471, R472, R473, R474, and R475 on the AGL7 circuit board. (See Figure 3-2.)

6. Turn all the variable resistors completely counterclockwise.

7. Connect the probe tip from the oscilloscope CH1 input to TP501.

8. Connect the probe tip from the oscilloscope CH2 input to TP430.

9. Set the oscilloscope settings as indicated below:

| | |
|---|---|
| Vertical | 500 mV/div |
| Vertical position | –3.0 div |
| Horizontal | 2 ns/div |
| Trigger source | CH1 |
| Trigger level | 1.5 V |
| Trigger slope | Rising Edge |

**10.** Adjust R470 so that the CH2 signal is delayed by 4 ±0.5 ns from the CH1 signal. (See Figure 3-4.)

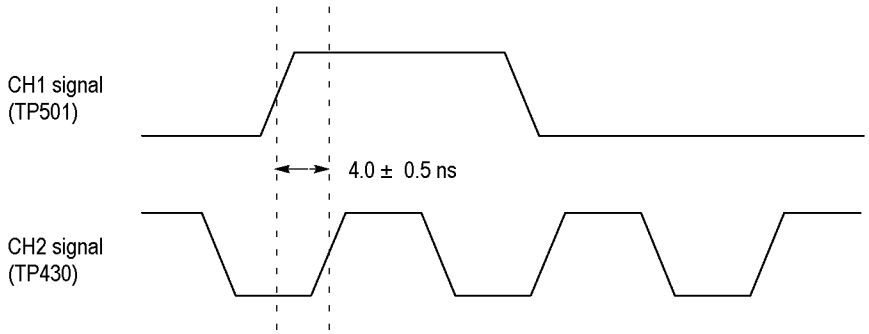



**Figure 3-4: Timing relationship between CH1 and CH2 signals**

**11.** Move the CH1 probe from TP501 to TP502.

**12.** Change the horizontal fine timing of the BLACK 3 output from –7.0 ns to +7.0 ns and verify that the CH2 signal moves at least 13.5 ns.

**13.** If the CH2 signal moves less than 13.5 ns, turn R471 to its center position and then perform the following steps:

**a.** Move the CH1 probe from TP502 to TP501.

**b.** Set the horizontal fine timing of BLACK 3 output to 0.00 ns.

**c.** Adjust R470 so that the CH2 signal is delayed by 4 ±0.5 ns from the CH1 signal.

**d.** Change the horizontal fine timing of the BLACK 3 output from –7.0 ns to +7.0 ns and verify that the CH2 signal moves at least 13.5 ns.

If the CH2 signal still moves less than 13.5 ns, turn R471 completely clockwise and then repeat parts a through d.

**14.** Change the CH2 probe connection from TP430 to TP410.

**15.** Adjust R472 so that the CH2 signal is delayed by 8 ±0.5 ns from the CH1 signal.

**16.** Change the CH1 probe connection from TP502 to TP504.

**17.** Change the horizontal fine timing of the BLACK 1 output from –10.0 ns to +10.0 ns and verify that the CH2 signal moves at least 18.5 ns.

**18.** If the CH2 signal moves less than 18.5 ns, turn R473 its center position and then perform the following steps:

**a.** Change the CH1 probe connection from TP504 to TP502.

**b.** Set the horizontal fine timing of BLACK 1 output to 0.00 ns.

**c.** Adjust R472 so that the CH2 signal is delayed by 8 ±0.5 ns from the CH1 signal.

**d.** Change the horizontal fine timing of the BLACK 1 output from –10.0 ns to +10.0 ns and verify that the CH2 signal moves at least 18.5 ns.

If the CH2 signal still moves less than 18.5 ns, turn R473 completely clockwise and then repeat parts a through d.

**19.** Change the CH2 probe connection from TP410 to TP420.

**20.** Adjust R474 so that the CH2 signal is delayed by 8 ±0.5 ns from the CH1 signal.

**21.** Change the CH1 probe connection from TP504 to TP502.

**22.** Change the horizontal fine timing of the BLACK 2 output from –10.0 ns to +10.0 ns and verify that the CH2 signal moves at least 18.5 ns.

**23.** If the CH2 signal moves less than 18.5 ns, turn R475 its center position and then perform the following steps:

**a.** Change the CH1 probe connection from TP502 to TP504.

**b.** Set the horizontal fine timing of BLACK 2 output to 0.00 ns.

**c.** Adjust R474 so that the CH2 signal is delayed by 8 ±0.5 ns from the CH1 signal.

**d.** Change the horizontal fine timing of the BLACK 2 output from –10.0 ns to +10.0 ns and verify that the CH2 signal moves at least 18.5 ns.

If the CH2 signal still moves less than 18.5 ns, turn R475 completely clockwise and then repeat parts a through d.

# AGL7 Analog Genlock Module Maintenance

This section contains instructions and procedures for maintaining the AGL7 Genlock module. Before following these procedures, read *Maintenance for Generators and Modules*. (See page xix.)

The following information can be found in this section:

- Removal and Replacement (See page 3-12.)
- Troubleshooting (See page 3-14.)

If the instrument does not function properly, troubleshooting and corrective measures should be taken immediately to prevent additional problems.

***NOTE.*** *Contact your local Tektronix representative for information on where to return your instrument if it requires repair during the warranty period.*

# AGL7 Analog Genlock Module Removal and Replacement

This section contains the instructions on how you can remove and replace the customer replaceable parts of the AGL7 Genlock module.

## Tools Required

The following tools are required to perform the removal and replacement procedures:

**Table 3-2: Required tools for removal and replacement of AGL7 Analog Genlock module**

| Name | Description | Tektronix part number |
|---|---|---|
| Screwdriver handle | Accepts Phillips-driver bits | |
| #1 Phillips tip | Phillips-driver bit for #1 size screw heads | |
| #2 Phillips tip | Phillips-driver bit for #2 size screw heads | |
| Nut driver, 14 mm | Special nut driver for removing the BNC connectors of the AGL7 module | 003-A041-00 |

## Replacing the Rear-Panel Connectors and Chassis

It is usually not necessary to replace the rear-panel connectors or chassis. However, if a connector or chassis becomes damaged, you can replace it.

### Replacing the Rear-Panel Connectors

Perform the following procedure to replace the rear-panel connector:

1. Use the *Removing a Module* section to remove the AGL7 Genlock module from the mainframe. (See page 1-41, *Removing a Module*.)
2. Disconnect the cables at CH1_OUT (BLACK1 BNC), CH2_OUT (BLACK2 BNC), CH3_OUT (BLACK3 BNC), RF(R)IN (Right RF BNC), RF(L)IN (Center RF BNC), and CW_IN (CW BNC) on the AGL7 circuit board.
3. Use the 14 mm nut driver to remove the nut securing the damaged connector to the chassis. Pull the connector away.
4. Perform steps 2 and 3 in reverse order to replace the connector.

***NOTE.*** *When you are reinstalling the BNC cables, dress the cables so that the top three cables cross over the bottom three cables at right angles. In addition, position the cables to minimize bending at the exit points of the black heat shrink. (That is, make bends in the brown portion of the coax cable between the heat shrink tubing ends, not within the heat shrink.) (See Figure 3-5.)*

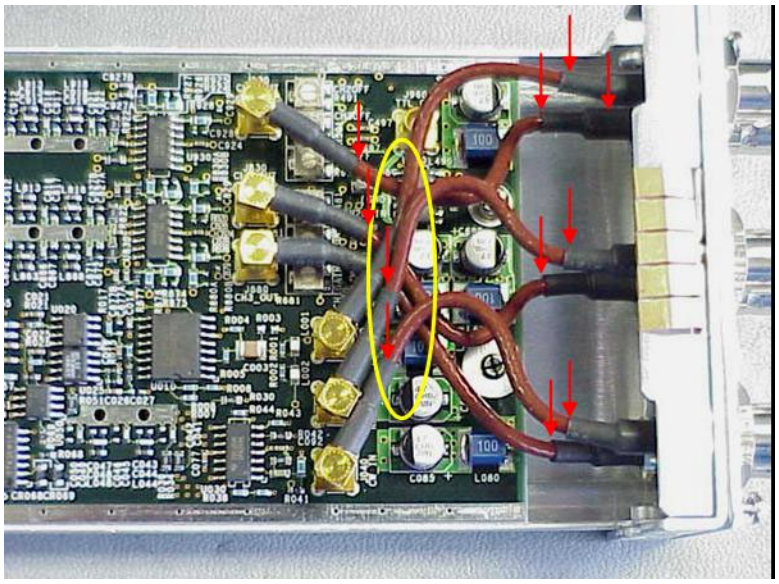


Figure 3-5: Dressing the AGL7 BNC cables

## Replacing the Chassis

Perform the following procedure to replace the chassis:

1. Use the 14 mm nut driver to remove the nuts from each of the rear-panel connectors.
2. Use a screwdriver with a #2 Phillips tip to remove the six screws securing the AGL7 circuit board to the chassis.
3. Lift the circuit board up and away from chassis, and then place it on a static free surface.
4. Set the replacement chassis on a firm, flat, static-free work surface.
5. Carefully place the circuit board in place on the chassis.
6. Use a screwdriver with a #2 Phillips tip to install the five screws securing the circuit board to the chassis.
7. Apply the rear panel to the chassis, and then install all the rear-panel connectors to the chassis.

# AGL7 Analog Genlock Module Troubleshooting

This section contains instructions and procedures for troubleshooting the AGL7 Genlock module. These procedures will help you decide whether it is necessary to replace your module.

If the TG700 mainframe does not boot up or if the display is not working, refer to the *TG700 Mainframe Troubleshooting* section in this manual. (See page 1-24, *TG700 Mainframe Troubleshooting*.)

## Equipment Required

The equipment listed in the following table is required for troubleshooting.

**Table 3-3: Equipment required for AGL7 Analog Genlock module troubleshooting**

| Equipment description | Minimum requirements/example |
|---|---|
| Screwdriver handle | Accept Phillips-driver bits |
| #1 Phillips tip | Phillips-driver bit for #1 size screw heads |
| TG700 mainframe | A TG700 mainframe that is functioning correctly |

## Backing Up the Instrument Settings

Before you begin the troubleshooting procedures, create a preset to save your instrument settings as follows:

1. Press the **MODULE** button until the mainframe main menu (TG700: PRESET) appears.
2. Press the **ENTER** button to access the PRESET submenu.
3. Press the up (▲) or down (▼) arrow button to select **SAVE**.
4. Press the left (◄) or right (►) arrow button to select a preset number to save instrument settings.
5. Press the **ENTER** button to save the current instrument settings to the new preset.

After the problem is solved, recall the preset you created.

## Troubleshooting Trees

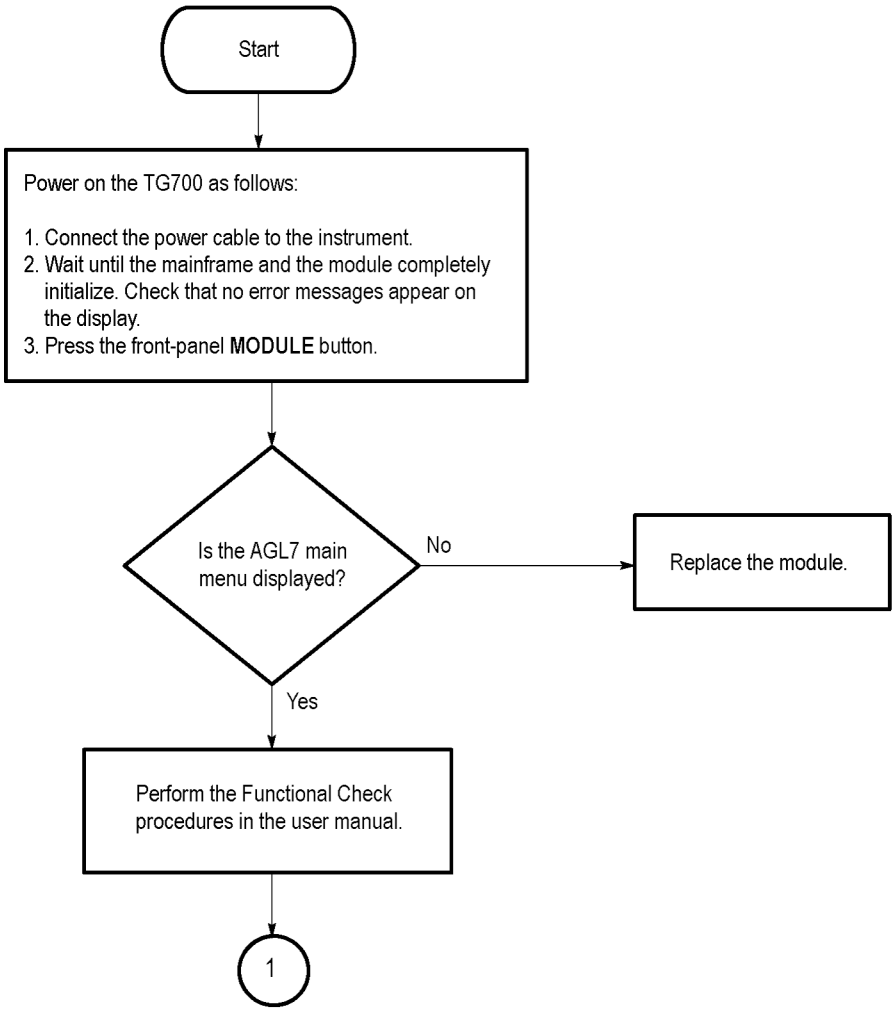

Start
Power on the TG700 as follows:
1. Connect the power cable to the instrument.
2. Wait until the mainframe and the module completely initialize. Check that no error messages appear on the display.
3. Press the front-panel MODULE button.
Is the AGL7 main menu displayed?
No
Replace the module.
Yes
Perform the Functional Check procedures in the user manual.
1

**Figure 3-6: Troubleshooting procedure (1)**

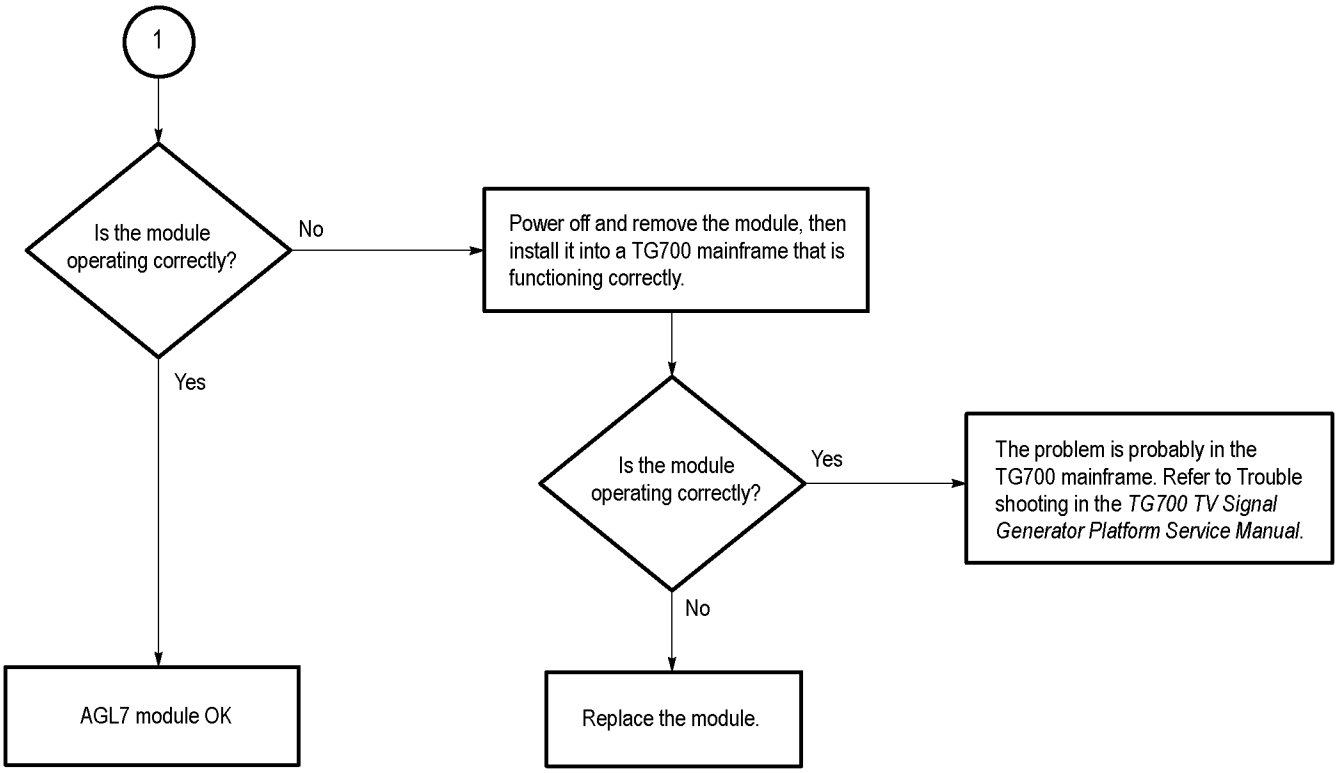

1
Is the module operating correctly?
No
Power off and remove the module, then install it into a TG700 mainframe that is functioning correctly.
Yes
Is the module operating correctly?
Yes
The problem is probably in the TG700 mainframe. Refer to Trouble shooting in the TG700 TV Signal Generator Platform Service Manual.
No
AGL7 module OK
Replace the module.

**Figure 3-7: Troubleshooting procedure (2)**

# AGL7 Analog Genlock Module Diagram

The following figure shows the AGL7 Genlock module and how it interconnects with the TG700 TV Signal Generator Platform. Diagrams showing mainframe component interconnections, such as power supply and oscillator, can be found in the *TG700 Diagram* section of this manual. (See page 1-28, *TG700 Mainframe Diagrams*.)

A block diagram of the AGL7 Genlock module is located in the *AGL7 Theory of Operation* section. (See page 3-1.)

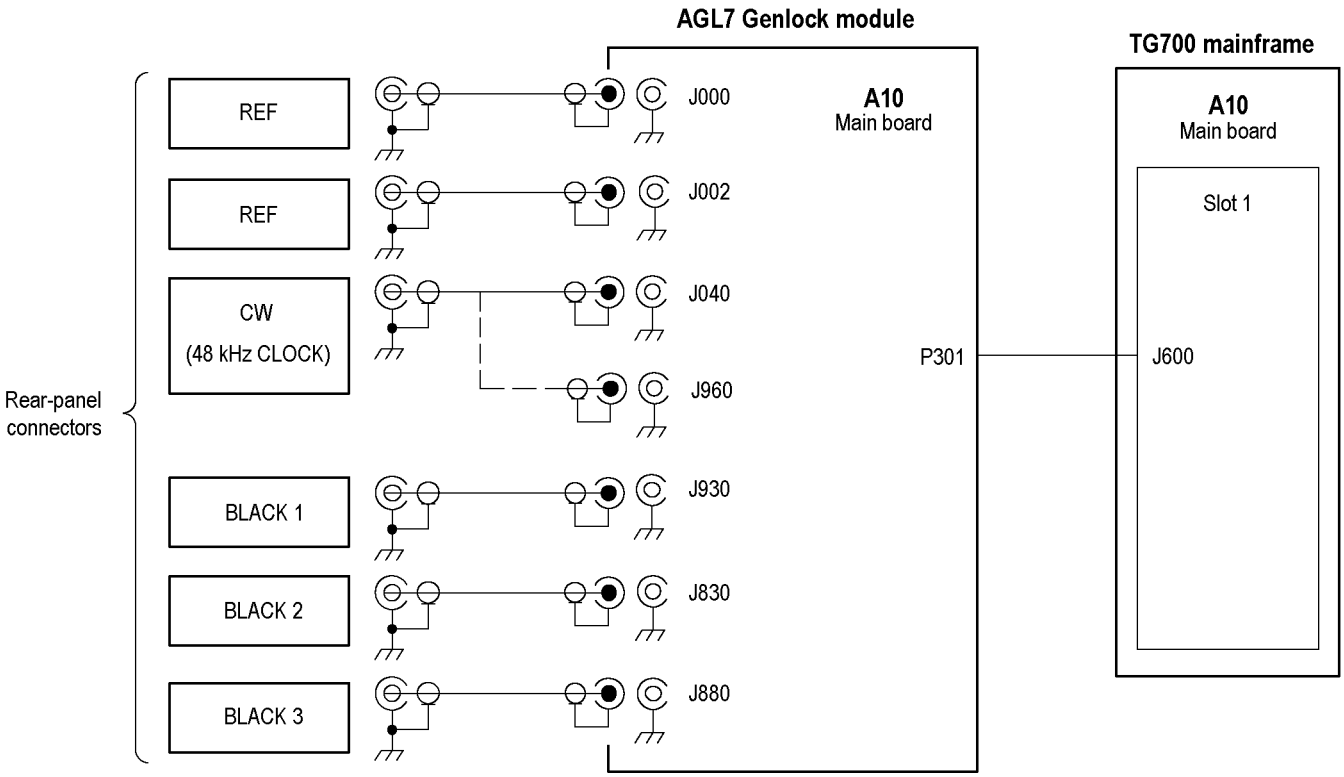



**Figure 3-8: AGL7 Genlock module connections**

# AGL7 Analog Generator Module Replaceable Parts List

This section contains a list of the replaceable modules for the AGL7 Genlock module. Use this list to identify and order replacement parts. For parts ordering or servicing information, see *Parts Ordering Information* or *Module Servicing* in the *TG700 Mainframe Replaceable Parts List* section of this manual. (See page 1-31, *TG700 Mainframe Replaceable Parts List*.)

## Abbreviations

Abbreviations conform to American National Standard ANSI Y1.1-1972.

### Table 3-4: AGL7 Analog Generator module – replaceable parts

| Fig. & index number | Tektronix part number | Serial no. effective | Serial no. discont'd | Qty | Name & description |
|---|---|---|---|---|---|
| 3-9- | 116-1125-00 | | | 1 | EXCHANGE MODULE:AGL7 |
| 3-9-1 | 441-A269-02 | | | 1 | CHASSIS,MODULE AGL7:ASSY |
| -2 | 333-A405-00 | | | 1 | PANEL,REAR:AGL7,AL |
| -3 | 214-4946-00 | | | 2 | SPRING,CONICAL:VXI MOUNTING SCREW,0.26 MM SUS304,5.4 MML |
| -4 | 213-1129-01 | | | 2 | SCREW,MACHINE:M2.5X11MM L,PAN HD,STL,N1 PL,CROSS REC & SLOTTED |
| -5 | 348-A128-00 | | | 2.5 CM | SHLD GASKET,ELEK:FINGER TYPE,5.1MM LX6.4MM W,BE-CU [97-645-02] |
| -6 | 174-B851-00 | | | 1 | CA ASSY,RF; 75 OHM,COAX,RG179,5.5 CM L,BNC TO MCX |
| -7 | 211-A245-01 | | | 5 | SCREW,MACHINE:M3X6MM L,PNH,STL,NI PL,CROSS REC,W/KOGATAMARU&LOCK WASHER |
| -8 | 334-1378-03 | | | 1 | MARKER,IDENT:MKD SERIAL NO. |
| -9 | 342-A146-00 | | | 1 | INSULATOR,PLATE:HEAT CONDUCTOR,RUBBER,20MMX20MMX100MM THK [TC1000-TKC] |
| -10 | 174-B847-00 | | | 5 | CABLE ASSY,RF:75OHM COAX(RG179),7.5CM L,BNC TO MCX |
| | | | **STANDARD ACCESSORIES** | | |
| | 075-0986-XX | | | 1 | MANUAL,TECH:MODULE INSTALLATION INSTRUCTIONS |
| | 063-3939-XX | | | 1 | KIT: SOFTWARE LIBRARY, DOCUMENTATION DVD |
| | | | **OPTIONAL ACCESSORIES** | | |
| | 003-A041-00 | | | 1 | NUTDRIVER,BOX:14MM HEX,BNC RETAINING NUT, MODIFIED 19MM |

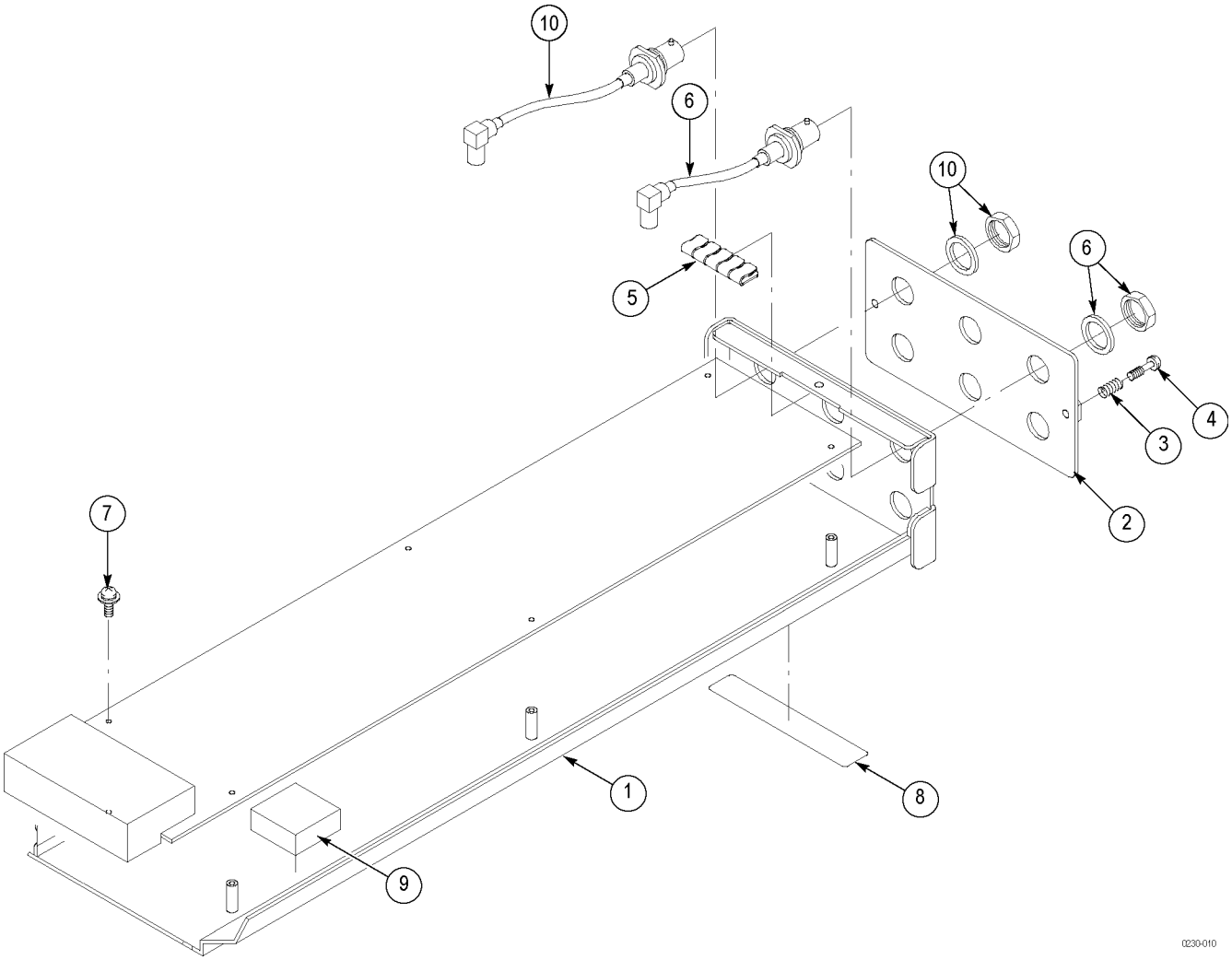



**Figure 3-9: AGL7 Genlock module exploded view**

# ATG7 Analog Test Generator

# ATG7 Analog Test Generator Theory of Operation

This section describes the basic operation of the major circuit blocks in the ATG7 Generator module.

### Bus Interface

This block provides the communication between the mainframe and the module circuit.

### Black Burst Generator

This block generates NTSC or PAL black burst digital data.

### BARS Generator

This block generates digital data for color bars, black burst, and other signals.

### SIGNAL Generator

This block generates digital data for the test signals assigned to the front-panel buttons.

### D/A Converter & Amp

This block consists of a D/A converter, two amplifiers, and a filter. It converts the digital data from the black burst generator, BARS generator, and SIGNAL generator to analog signal and reconstruct the signal for output.

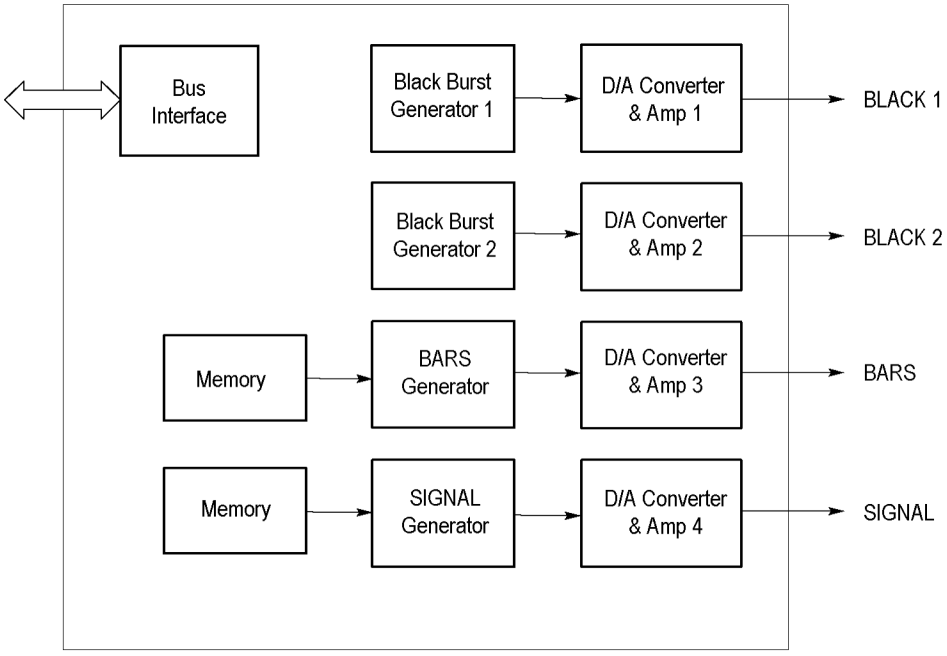



**Figure 4-1: Simplified block diagram of the ATG7 Generator module**

# ATG7 Analog Test Generator Maintenance

This section contains instructions and procedures for maintaining the ATG7 Generator module. Before following these procedures, read *Maintenance for Generators and Modules*. (See page xix.)

The following information can be found in this section:

- Removal and Replacement (See page 4-3.)
- Troubleshooting (See page 4-5.)

If the instrument does not function properly, troubleshooting and corrective measures should be taken immediately to prevent additional problems.

***NOTE.*** *Contact your local Tektronix representative for information on where to return your instrument if it requires repair during the warranty period.*

# ATG7 Analog Test Generator Removal and Replacement

This section contains the instructions on how you can remove and replace the customer replaceable parts of the ATG7 Generator module.

## Tools Required

The following tools are required to perform the removal and replacement procedures:

**Table 4-1: Required tools for removal and replacement of ATG7 Test Generator**

| Name | Description | Tektronix part number |
|---|---|---|
| Screwdriver handle | Accepts Phillips-driver bits | |
| #1 Phillips tip | Phillips-driver bit for #1 size screw heads | |
| #2 Phillips tip | Phillips-driver bit for #2 size screw heads | |
| Nut driver, 14 mm | Special nut driver for removing the BNC connectors of the ATG7 module | 003-A041-00 |

## Replacing the Rear-Panel Connectors and Chassis

It is usually not necessary to replace the rear-panel connectors or chassis. However, if a connector or chassis becomes damaged, you can replace it.

### Replacing the Rear-Panel Connectors

To replace the rear-panel connector:

1. Use the *Removing a Module* section to remove the ATG7 Generator module from the mainframe. (See page 1-41, *Removing a Module*.)
2. Disconnect the cables at J830 (BLACK 1), J880 (BLACK 2), J930 (SIGNAL) and J980 (BARS) on the ATG7 circuit board.
3. Use the 14 mm nut driver to remove the nut securing the damaged connector to the chassis. Pull the connector away.
4. Perform steps 2 and 3 in reverse order to replace the connector.

## Replacing the Chassis

Perform the following procedure to replace the chassis:

1. Use the 14 mm nut driver to remove the nuts from each of the rear-panel connectors.
2. Use a screwdriver with a #2 Phillips tip to remove the five screws securing the ATG7 circuit board to the chassis.
3. Lift the circuit board up and away from chassis, and then place it on a static free surface.
4. Set the replacement chassis on a firm, flat, static-free work surface.
5. Carefully place the circuit board in place on the chassis.
6. Use a screwdriver with a #2 Phillips tip to install the five screws securing the circuit board to the chassis.
7. Apply the rear panel to the chassis, and then install all the rear-panel connectors to the chassis.

# ATG7 Analog Test Generator Troubleshooting

This section contains instructions and procedures for troubleshooting the ATG7 Generator module. These procedures will help you decide whether it is necessary to replace your module.

If the TG700 mainframe does not boot up or if the display is not working, refer to the *TG700 Troubleshooting* section in this manual. (See page 1-24, *TG700 Mainframe Troubleshooting*.)

## Equipment Required

The equipment listed in the following table is required for troubleshooting.

**Table 4-2: Equipment required for ATG7 Test Generator troubleshooting**

| Equipment description | Minimum requirements/example |
|---|---|
| Screwdriver handle | Accept Phillips-driver bits |
| #1 Phillips tip | Phillips-driver bit for #1 size screw heads |
| TG700 mainframe | A TG700 mainframe that is functioning correctly |

## Backing Up the Instrument Settings

Before you begin troubleshooting, create a preset to save your instrument settings as follows:

1. Press the **MODULE** button until the mainframe main menu (TG700: PRESET) appears.
2. Press the **ENTER** button to access the PRESET submenu.
3. Press the up (▲) or down (▼) arrow button to select **SAVE**.
4. Press the left (▲) or down (▼) arrow button to select a preset number to save instrument settings.
5. Press the **ENTER** button to save the current instrument settings to the new preset.

After the problem is solved, recall the preset you created.

## Troubleshooting Trees

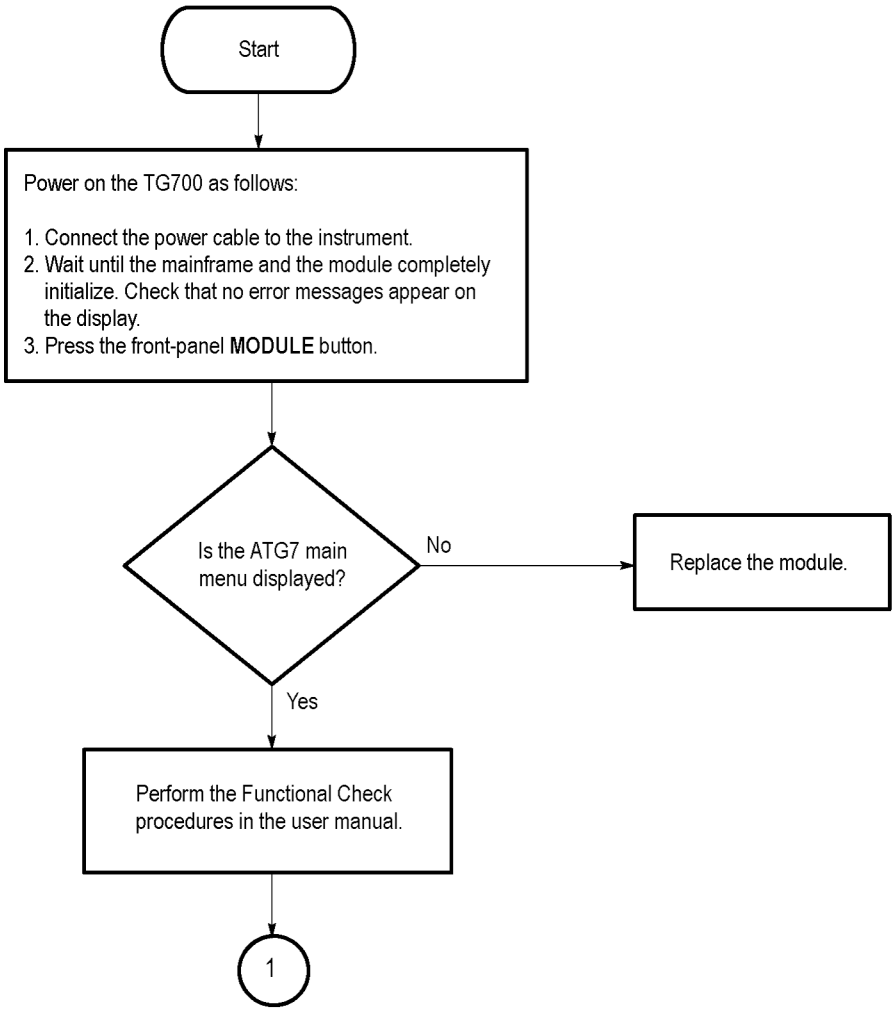

Start
Power on the TG700 as follows:
1. Connect the power cable to the instrument.
2. Wait until the mainframe and the module completely initialize. Check that no error messages appear on the display.
3. Press the front-panel MODULE button.
Is the ATG7 main menu displayed?
No
Replace the module.
Yes
Perform the Functional Check procedures in the user manual.
1

**Figure 4-2: Troubleshooting procedure (1)**

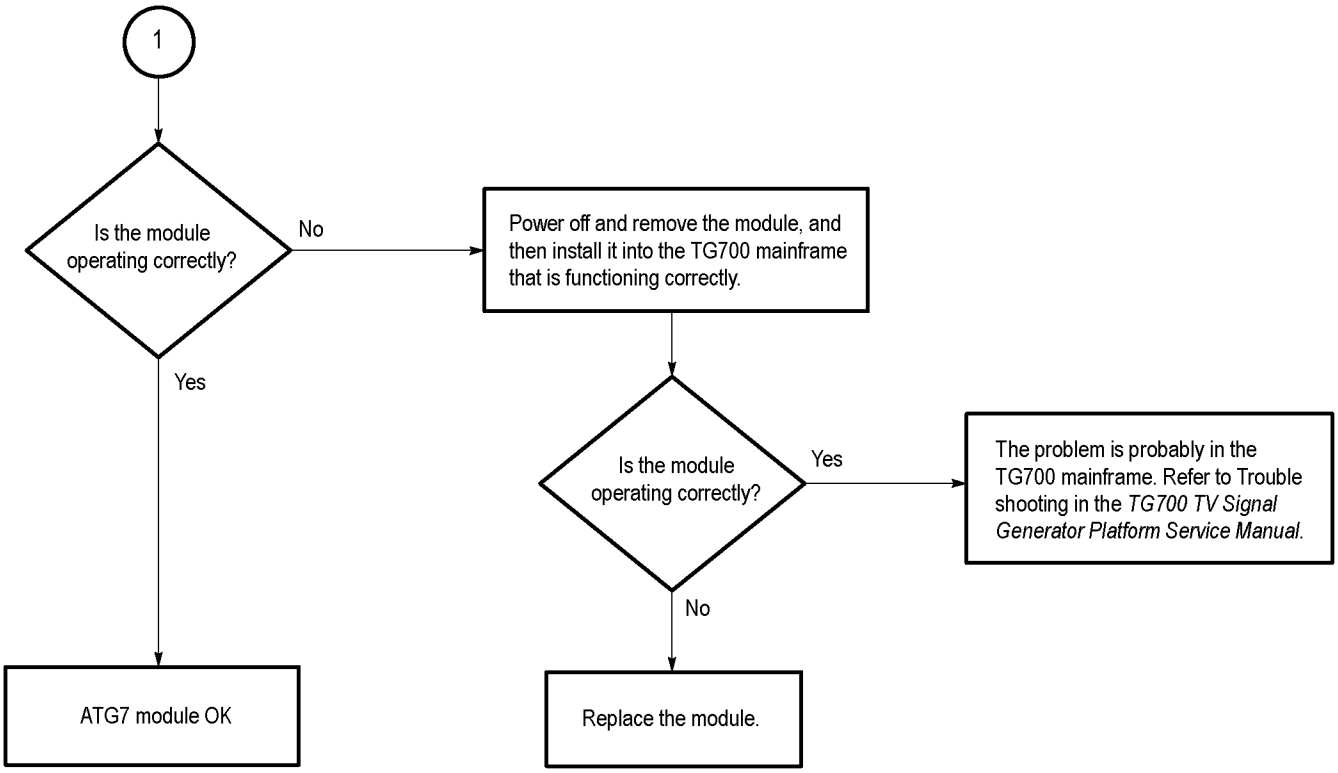

1
Is the module operating correctly?
No
Power off and remove the module, and then install it into the TG700 mainframe that is functioning correctly.
Yes
Is the module operating correctly?
Yes
The problem is probably in the TG700 mainframe. Refer to Trouble shooting in the TG700 TV Signal Generator Platform Service Manual.
No
ATG7 module OK
Replace the module.

**Figure 4-3: Troubleshooting procedure (2)**

# ATG7 Analog Test Generator Diagram

The following figure shows the ATG7 Generator module and how it interconnects with the TG700 TV Signal Generator Platform.

Diagrams showing mainframe component interconnections, such as power supply and oscillator, can be found in the *TG700 Diagram* section of this manual. (See page 1-28, *TG700 Mainframe Diagrams*.)

A block diagram of the ATG7 Generator module is located in the *ATG7 Theory of Operation* section. (See page 4-1.)

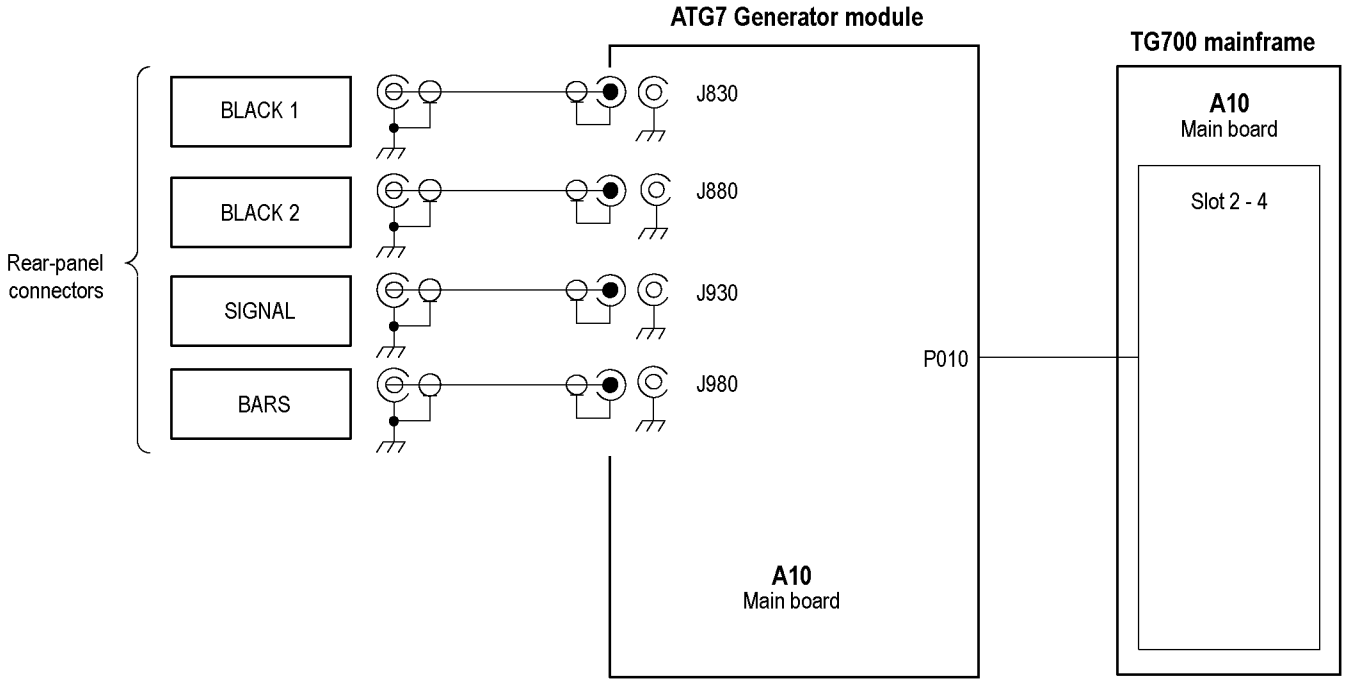



**Figure 4-4: ATG7 Generator module connections**

# ATG7 Analog Test Generator Replaceable Parts List

This section contains a list of the replaceable modules for the ATG7 Generator module. Use this list to identify and order replacement parts. For parts ordering or servicing information, see *Parts Ordering Information* or *Module Servicing* in the *TG700 Mainframe Replaceable Parts List* section of this manual. (See page 1-31, *TG700 Mainframe Replaceable Parts List*.)

## Abbreviations

Abbreviations conform to American National Standard ANSI Y1.1-1972.

### Table 4-3: ATG Analog Test Generator – replaceable parts

| Fig. & index number | Tektronix part number | Serial no. effective | Serial no. discont'd | Qty | Name & description |
|---|---|---|---|---|---|
| 4-5- | 116-A014-00 | | | 1 | EXCHANGE MODULE:ATG7 |
| 4-5-1 | 441-A269-02 | | | 1 | CHASSIS,MODULE AGL7:ASSY |
| -2 | 333-A427-00 | | | 1 | PANEL,REAR:ATG7,AL |
| -3 | 214-4946-00 | | | 2 | SPRING,CONICAL:VXI MOUNTING SCREW,0.26 MM SUS304,5.4 MML |
| -4 | 213-1129-01 | | | 2 | SCREW,MACHINE:M2.5X11MM L,PAN HD,STL,N1 PL,CROSS REC & SLOTTED |
| -5 | 348-A128-00 | | | 2.5 CM | SHLD GASKET,ELEK:FINGER TYPE,5.1MM LX6.4MM W,BE-CU [97-645-02] |
| -6 | 174-B851-00 | | | 4 | CABLE ASSY,RF:75OHM COAX(RG179),5.5CM L,BNC TO MCX |
| -7 | 211-A245-01 | | | 5 | SCREW,MACHINE:M3X6MM L,PNH,STL,NI PL,CROSS REC,W/KOGATAMARU&LOCK WASHER |
| -8 | 334-1378-03 | | | 1 | MARKER,IDENT:MKD SERIAL NO. |
| | | | **STANDARD ACCESSORIES** | | |
| | 075-0986-XX | | | 1 | MANUAL,TECH:MODULE INSTALLATION INSTRUCTIONS |
| | 063-3939-XX | | | 1 | KIT: SOFTWARE LIBRARY, DOCUMENTATION DVD |
| | | | **OPTIONAL ACCESSORIES** | | |
| | 003-A041-00 | | | 1 | NUTDRIVER,BOX:14MM HEX,BNC RETAINING NUT, MODIFIED 19MM |

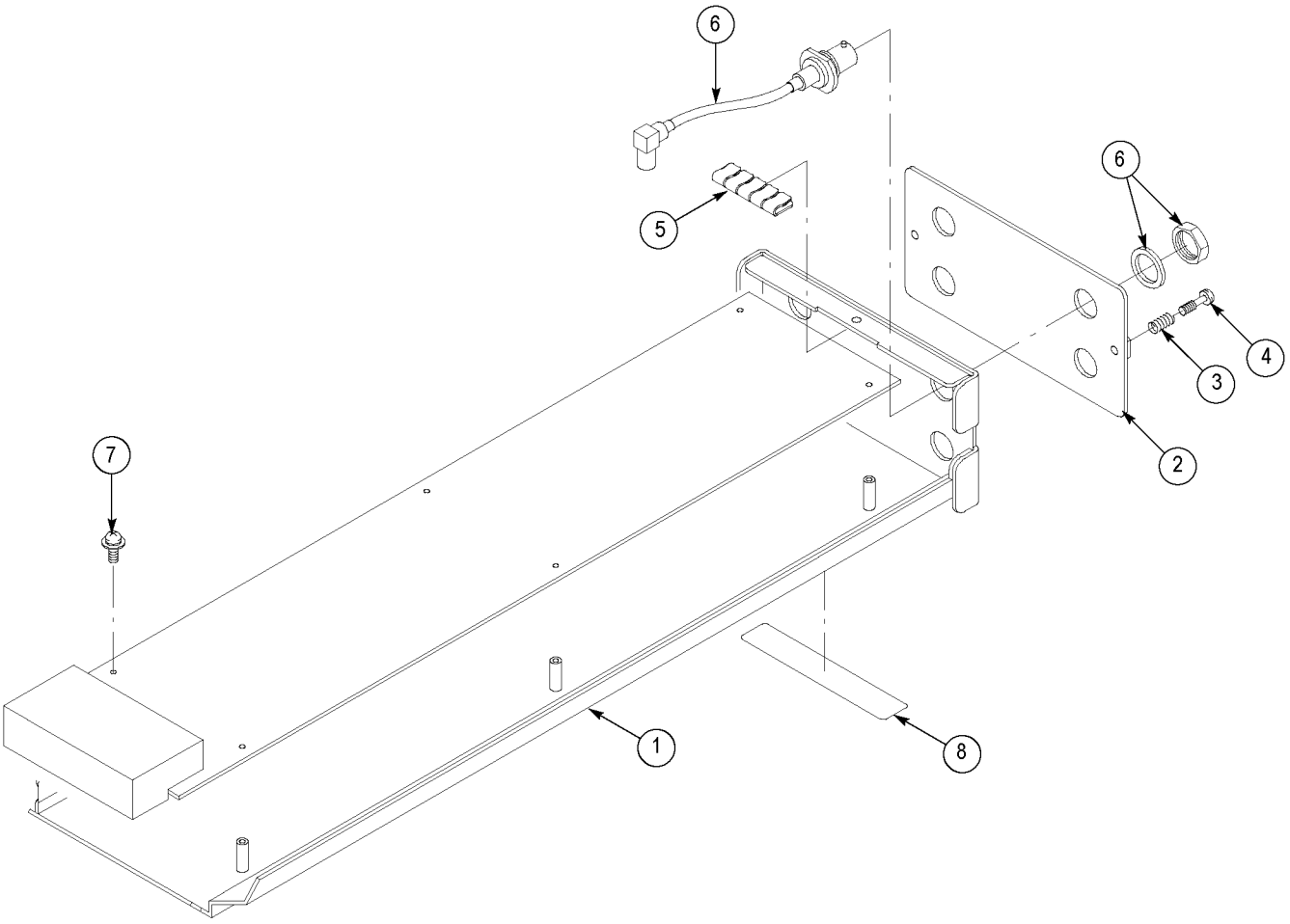



**Figure 4-5: ATG7 Generator module exploded view**

# AVG7 Analog Video Generator

# AVG7 Analog Video Generator Theory of Operation

This section describes the basic operation of the major circuit blocks in the AVG7 Generator module.

**Bus Interface** This block provides the communication between the mainframe and the module circuit.

**Line Memory** Line memory holds the actual sample points which define a digital signal.

**Address Generator** This block consists of a frame delay, an MPU interface, a sequencer, an SDRAM controller, and a blanking data generator. It interfaces the Frame Memory and the Line Memory and controls the output sequence of the video data in these memories.

**Frame Memory** Frame memory contains a series of pointers that control the order the video lines stored in the Line Memory are used to produce digital signals.

**Overlay Controller** This block consists of an MPU interface and an overlay controller. It inserts data from the Overlay Memory into the Line Memory data stream to create circular patterns, ID text, and logo.

**Overlay Memory** Overlay memory generates timings to multiplex the line memory data and the overlay data used for a circle, ID text, and logo overlay.

**D/A Converter & Amp** This block consists of a D/A converter, two amplifiers, and a filter. It converts the digital data from the Overlay Controller to analog signal and reconstruct the signal for output.

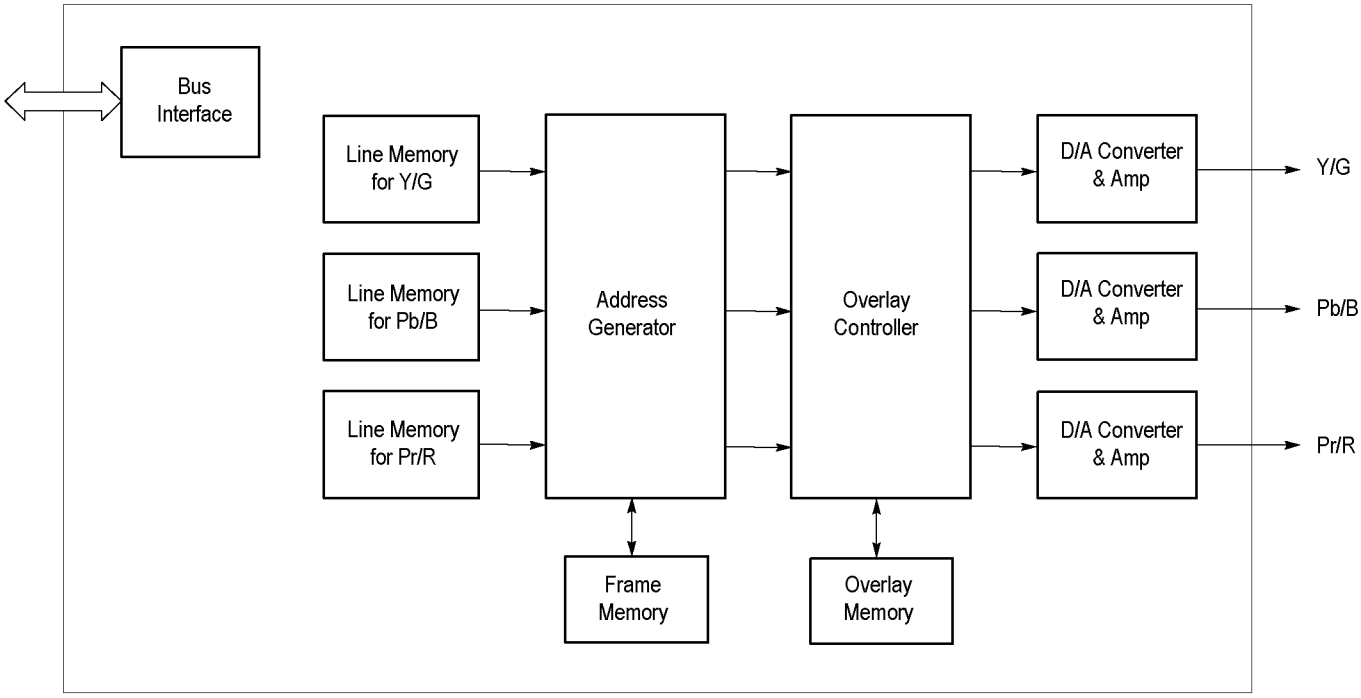



**Figure 5-1: Simplified block diagram of the AVG7 Generator module**

# AVG7 Analog Video Generator Adjustment Procedures

This section contains information needed to adjust the AVG7 Generator module.

Adjustment in the AVG7 Generator module are for the output offset and gain, frame timing and clock timing, group delay, frequency response, and interchannel delay.

## Requirements for Adjustment

Before doing the adjustment, note the following requirements:

### Personnel

This procedure is only to be performed by trained service technicians.

### Warm-Up Period

The AVG7 Generator module requires a 20 minute warm-up time in a +20 °C to +30 °C environment before it is adjusted. Adjustments done before the operating temperature has stabilized may cause errors in performance.

***WARNING.*** *To avoid potential shock, which could cause injury or death, use caution when removing the TG700 mainframe top cover with power connected.*

### Access

When adjusting the AVG7 Generator module, remove the top cover of the TG700 mainframe. (See page 1-15, *Top Cover*.)

***NOTE.*** *If the serial number of your instrument is B010600 and above, replace the resistor and capacitor numbers in the figures and procedures as follows:*

*R6xxx → R6xxx_1 (for example, R651A → R651A_1)*

*R7xxx → R6xxx_2 (for example, R751A → R651A_2)*

*R8xxx → R6xxx_3 (for example, R851A → R651A_3*

*C6xxx → R6xxx_1 (for example, C604B → C604B_1)*

*C7xxx → R6xxx_2 (for example, C704B → C604B_2)*

*C8xxx → R6xxx_3 (for example, C804B → C604B_3)*

## Equipment Required

The following table lists the equipment required to adjust the output offset and gain, frame timing and clock timing, group delay, frequency response, and interchannel delay.

**Table 5-1: Equipment required AVG7 Analog Video Generator adjustment procedures**

| Item | No. | Minimum requirement | Recommended equipment |
|---|---|---|---|
| TV signal generator platform | 1 | | Tektronix TG700 |
| Test signal generator | 1 | | Tektronix ATG7 |
| Oscilloscope | 1 | Bandwidth: 1 GHz or higher Function: Mask testing | Tektronix TDS784D Option 2C |
| Digital multimeter | 1 | 5 1/2 digits | FLUKE 8842A |
| Peak detector amplifier | 1 | | Tektronix part number 015-0408-00 and TM500 series power supply |
| Peak detector head | 1 | | Tektronix part number 015-0413-00 |
| Probe | 2 | X 10 | Tektronix P6139A |
| 75 Ω BNC cable | 3 | Length: 72 inches | Tektronix part number 012-0159-01 |
| 75 Ω BNC cable | 1 | 5C-2V, 1 m | Canare DH5C01-S-SA |
| 75 Ω feed-through termination | 1 | | Tektronix part number 011-0103-02 |
| 75 Ω coaxial termination | 1 | | Tektronix part number 011-0102-03 |
| 75 Ω signal adapter | 2 | Bandwidth: 1 GHz Amplitude precision: –3 dB | Tektronix AMT75 |
| BNC T connector | 1 | | Tektronix part number 103-0030-00 |
| BNC female to dual banana adapter | 1 | | Tektronix part number 103-0090-00 |
| Flat blade screwdriver for adjusting C604B, C704B, and C804B | 1 | Bit shape: 2.2 × 0.4 mm | Murata KMDR010 |
| BNC female-to-female connector | 1 | | Canare BCJ-J |

## Output Offset and Gain Adjustment

### Preparation

To perform the output offset and gain adjustment, you must first remove the top cover of the TG700 mainframe. (See page 1-15, *Top Cover*.)

After you have removed the top cover, find the variable resistors on the AVG7 circuit board. (See Figure 5-2.)

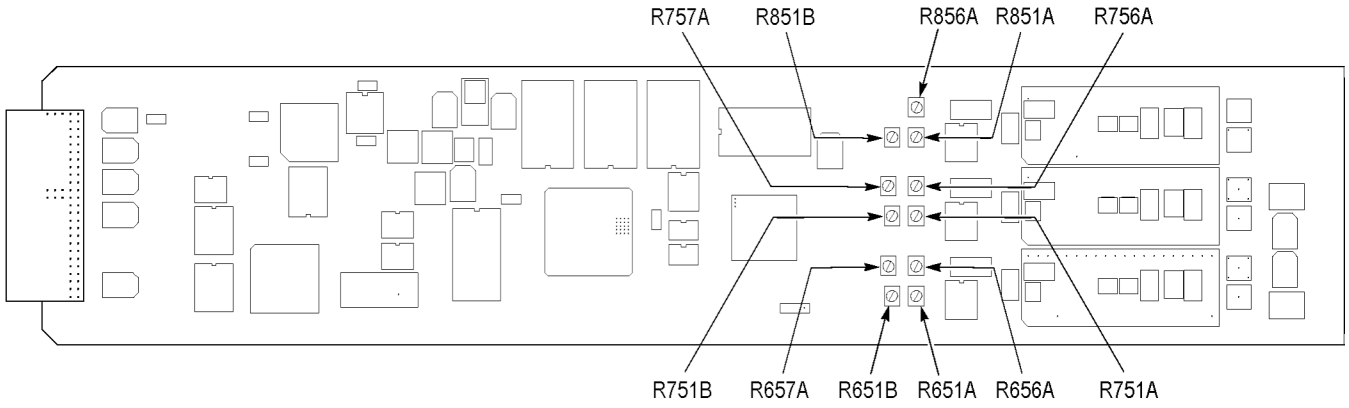



**Figure 5-2: Location of the variable resistors for the output offset and gain adjustment**

## Procedure

***WARNING.*** *To avoid serious injury, do not touch exposed connectors or components when operating the TG700 mainframe with the top cover removed. Dangerous potentials exist at several points within the TG700 mainframe.*

1. Use the 75 Ω BNC cable, BNC T connector, 75 Ω coaxial termination, and BNC female-to-dual banana adapter to connect the upper CH 1 connector on the AVG7 Generator module to the INPUT connector on the digital multimeter. (See Figure 5-3.)

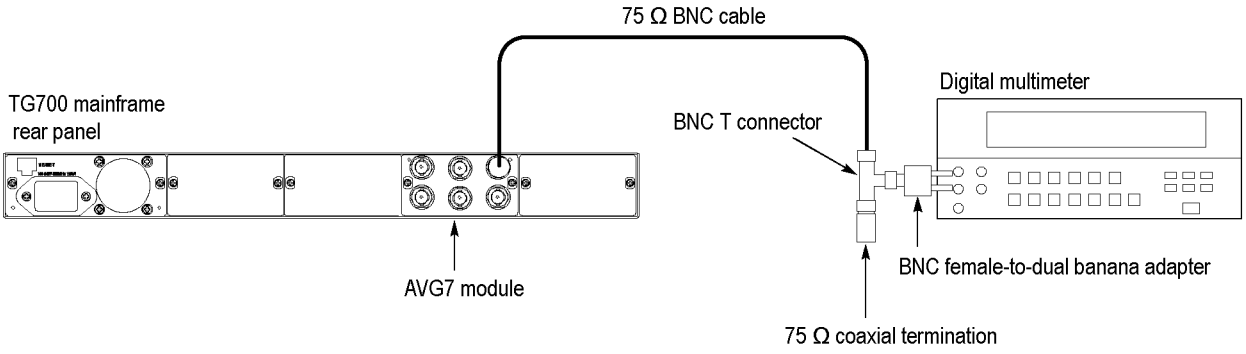



**Figure 5-3: Equipment connection for adjusting the output offset and gain**

2. Press the **MODULE**, **FORMAT**, and **FRONT PANEL ENABLE** buttons simultaneously, and then release the **MODULE** and **FORMAT** buttons to restart the instrument in Factory mode. Continue holding down the **FRONT PANEL ENABLE** button until the "TG700 Startup with Factory Mode." message appears.

3. Select the DAC Gain (GBR) : 0 mV calibration signal as follows:
   a. Press the **MODULE** button to display the **AVG7** main menu.
   b. Press the up (▲) or down (▼) arrow button to select **CALIBRATION**.
   c. Press the left (◄) or right (►) arrow button to select **DAC Gain (GBR)**, and then press the **ENTER** button.
   d. Press the left (◄) or right (►) arrow button to select **0mV**, and then press the **ENTER** button.
4. Locate variable resistor R856A on the AVG7 circuit board. (See Figure 5-2.)
5. Adjust R856A so that the output offset is 0 V ±1 mV.
6. Move the BNC cable from the upper CH 1 connector to the upper CH 2 connector on the AVG7 Generator module.
7. Locate variable resistor R756A on the AVG7 circuit board. (See Figure 5-2.)
8. Adjust R756A so that the output offset is 0 V ±1 mV.
9. Move the BNC cable from the upper CH 2 connector to the upper CH 3 connector on the AVG7 Generator module.
10. Locate variable resistor R656A on the AVG7 circuit board. (See Figure 5-2.)
11. Adjust R656A so that the output offset is 0 V ±1 mV.
12. Move the BNC cable from the upper CH 3 connector to the upper CH 1 connector on the AVG7 Generator module.
13. Press the left (◄) or right (►) arrow button to select **700.397mV**, and then press the **ENTER** button.
14. Locate variable resistors R851A (coarse) and R851B (fine) on the AVG7 circuit board. (See Figure 5-2.)
15. Adjust R851A and R851B so that the output gain is 700.4 mV ±1 mV.
16. Move the BNC cable from the upper CH 1 connector to the upper CH 2 connector on the AVG7 Generator module.
17. Locate variable resistors R751A (coarse) and R751B (fine) on the AVG7 circuit board. (See Figure 5-2.)
18. Adjust R751A and R751B so that the output gain is 700.4 mV ±1 mV.
19. Move the BNC cable from the upper CH 2 connector to the upper CH 3 connector on the AVG7 Generator module.
20. Locate variable resistors R651A (coarse) and R651B (fine) on the AVG7 circuit board. (See Figure 5-2.)
21. Adjust R651A and R651B so that the output gain is 700.4 mV ±1 mV.

22. Move the BNC cable from the upper CH 3 connector to the upper CH 2 connector on the AVG7 Generator module.
23. Select the DAC Gain (YPbPr) : 0 mV calibration signal for CH 2 and CH 3 as follows:
    a. Press the **CANCEL** button to display the **CALIBRATION** menu.
    b. Press the left (◄) or right (►) arrow button to select **DAC Gain (YPbPr)**, and then press the **ENTER** button.
    c. Press the left (◄) or right (►) arrow button to select **0mV**, and then press the **ENTER** button.
24. Locate variable resistor R757A on the AVG7 circuit board. (See Figure 5-2.)
25. Adjust R757A so that the output offset is 0 V ±1 mV.
26. Move the BNC cable from the upper CH 2 connector to the upper CH 3 connector on the AVG7 Generator module.
27. Locate variable resistor R657A on the AVG7 circuit board. (See Figure 5-2.)
28. Adjust R657A so that the output offset is 0 V ±1 mV.

## Frame Timing and Clock Timing Adjustments

***NOTE.*** *The instrument with serial number B010600 and above does not require this adjustments.*

### Preparation

To perform the frame timing and clock timing adjustment, you must first remove the top cover of the TG700 mainframe. (See page 1-15, *Top Cover*.)

After you have removed the top cover, find the test points on the AVG7 circuit board. (See Figure 5-4.)

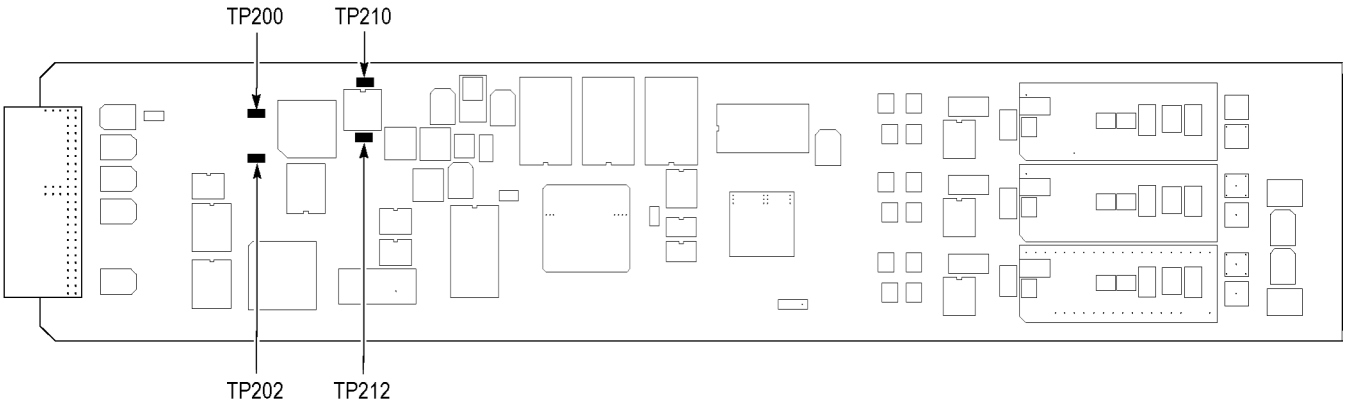



**Figure 5-4: Location of the test points for the frame timing and clock timing adjustment**

## Procedure

***WARNING.*** *To avoid serious injury, do not touch exposed connectors or components when operating the TG700 mainframe with the top cover removed. Dangerous potentials exist at several points within the TG700 mainframe.*

1. Attach the two P6139A probes to the oscilloscope CH 1 and CH 2 inputs.
2. Locate test points TP200, TP202, TP210, and TP212 on the AVG7 circuit board. (See Figure 5-4.)
3. Connect the probe tip from the oscilloscope CH 1 input to TP200.
4. Connect the probe tip from the oscilloscope CH 2 input to TP210.
5. Set the oscilloscope settings as indicated below:

| | |
|---|---|
| Vertical scale | CH 1: 500 mV/div, CH 2: 1 V/div |
| Vertical position | –2.0 div |
| Vertical offset | CH 1 : 3.3 V, CH 2 : 0 V |
| Horizontal scale | 5 ns/div |
| Horizontal length | 500 |
| Trigger position | 0% |
| Trigger source | CH 1 |
| Trigger type | Edge |
| Acquisition mode | Average 4 |
| Acquisition mode | Relative Signal OFF |
| Measure High-Low setup | Min-Max |

6. Check that both CH 1 and CH 2 waveforms are displayed stably and then turn off the CH 1 display.
7. Select Frame 0.0 nsec from the Frame Timing calibration menu as follows:
   a. Press the **MODULE** button to display the **AVG7** main menu.
   b. Press the up (▲) or down (▼) arrow button to select **CALIBRATION**.
   c. Press the left (◄) or right (►) arrow button to select **Frame Timing**, and then press the **ENTER** button.
   d. Press the left (◄) or right (►) arrow button to select **Frame 0.0 nsec**, and then press the **ENTER** button.
8. Save the CH 2 waveform on the oscilloscope in **Ref1**, and then display the saved waveform.
9. Select **Delay** from the Measure menu, and then set the oscilloscope to measure the time delay between the Ref1 and CH 2 waveforms.
10. Press the up (▲) or down (▼) arrow button to select **2.0 ns**.
11. While seeing the Delay Timing value on the oscilloscope, press the left (◄) or right (►) arrow button to adjust the delay value to 2.0 ns.
12. Press the up (▲) or down (▼) arrow button to select **10.0 ns**.
13. While seeing the Delay Timing value on the oscilloscope, press the left (◄) or right (►) arrow button to adjust the delay value to 10.0 ns.
14. Press the up (▲) or down (▼) arrow button to select **22.0 ns**.
15. While seeing the Delay Timing value on the oscilloscope, press the left (◄) or right (►) arrow button to adjust the delay value to 22.0 ns.
16. Press the **CANCEL** button to return the CALIBRATION menu.
17. Press the left (◄) or right (►) arrow button to select **Clock Timing**, and then press the **ENTER** button.
18. Move CH 1 probe from TP200 to TP202. Move Ch 2 probe from TP210 to TP212.
19. Press the up (▲) or down (▼) arrow button to select **Clock 0.0 nsec**, and then the **ENTER** button.
20. Save the waveform on the oscilloscope in **Ref1**.
21. Press the up (▲) or down (▼) arrow button to select **2.0 ns**.
22. While seeing the Delay Timing value on the oscilloscope, press the left (◄) or right (►) arrow button to adjust the delay value to 2.0 ns.
23. Save the waveform on the oscilloscope in **Ref1**, and then press the up (▲) or down (▼) arrow button to select **10.0 ns**.

24. While seeing the Delay Timing value on the oscilloscope, press the left (◄) or right (►) arrow button to adjust the delay value to 8.0 ns.
25. Save the waveform on the oscilloscope in **Ref1**, and then press the up (▲) or down (▼) arrow button to select **22.0 ns**.
26. While seeing the Delay Timing value on the oscilloscope, press the left (◄) or right (►) arrow button to adjust the delay value to 12.0 ns.
27. Press the **CANCEL** button to return to the CALIBRATION menu.

## Group Delay Adjustment

### Preparation

To perform the group delay adjustment, you must first remove the top cover of the TG700 mainframe. (See page 1-15, *Top Cover*.)

After you have removed the top cover, find the variable resistors and capacitors on the AVG7 circuit board. (See Figure 5-5.)

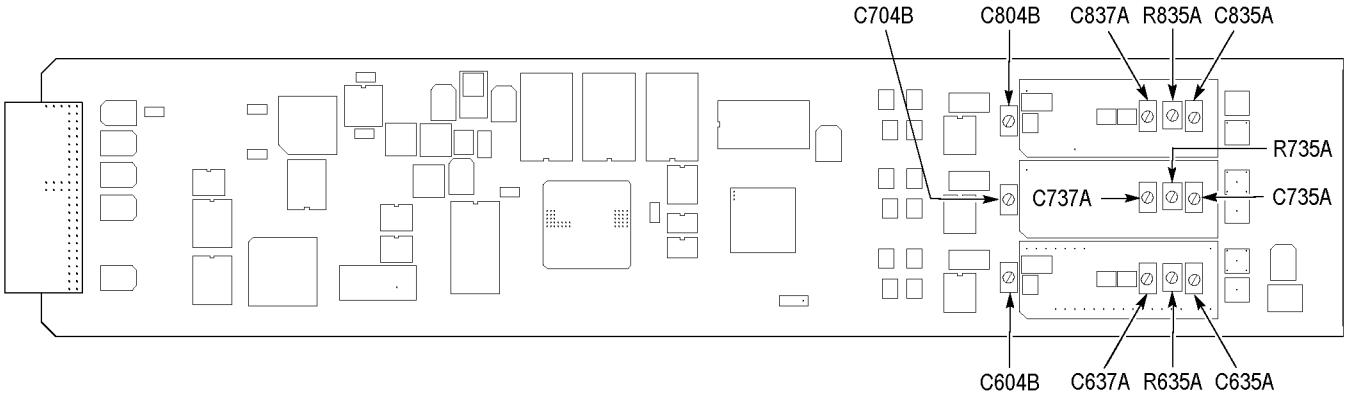



**Figure 5-5: Location of the variable resistors and capacitors for the group delay adjustment**

### Procedure

***WARNING.*** *To avoid serious injury, do not touch exposed connectors or components when operating the TG700 mainframe with the top cover removed. Dangerous potentials exist at several points within the TG700 mainframe.*

1. Use the 75 Ω BNC cable and the 75 Ω signal adapter to connect the upper CH 1 connector on the AVG7 Generator module to the CH 1 input connector on the oscilloscope. (See Figure 5-6.)
2. Use the 75 Ω BNC cable and the 75 Ω feed-through termination to connect the BLACK 1 connector on the test signal generator to the CH 2 input connector on the oscilloscope. (See Figure 5-6.)

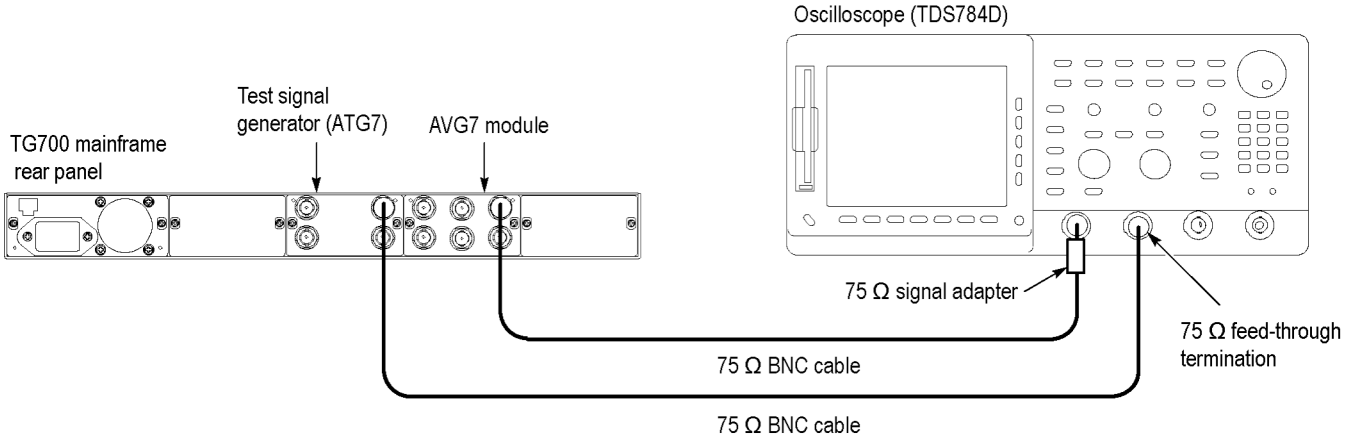



**Figure 5-6: Equipment connection for adjusting the group delay**

3. Set the oscilloscope settings as indicated below:

| | |
|---|---|
| Vertical scale | CH 1: 5 mV/div, CH 2: 1.00 V/div |
| Bandwidth | 250 MHz (CH 1) |
| Horizontal scale | 100 µs/div |
| Horizontal delay time | 200 ns/div |
| Delayed runs time | 993.472 µs (Delayed Only) |
| Trigger position | 50% |
| Trigger source | CH 2 |
| Trigger type | Edge |
| DPO (InstaVu) | Variable Persistence: 500 ms |
| CH 2 waveform | OFF |

4. Set the test signal generator (ATG7 module) settings as indicated below:

| | |
|---|---|
| Output selection | BLACK 1 |
| Signal format | PAL |
| Test signal | Field Reference |

5. Select the CCIR17 signal of the AVG7 Generator module as follows:

   a. Press the **MODULE** button to display the AVG7 main menu.

   b. Press the **FORMAT** button to select PAL-1, and then press the **ENTER** button.

   c. Press the **OTHER** button to select **CCIR17**.

6. Select the CH1/2/3: Composites video configuration as follows:

   a. Press the up (▲) or down (▼) arrow button to select **CONFIGURATION**, and then press the **ENTER** button to access the CONFIGURATION submenu.

   b. Press the left (◄) or right (►) arrow button to select **CH1/2/3: Composites**, and then press the **ENTER** button.

7. Locate variable capacitors C837A, C737A, C637A, C804B, C704B, C604B, C835A, C735A, and C635A, and variable resistors R835A, R735A, and R635A. (See Figure 5-6.)

8. Rotate C837A, C737A, and C637A 180° from its initial position and set R835A, R735A, and R635A to its center position.

9. Adjust C804B and C835A so that the baseline of the modulated 20T pulse signal is flat. (See Figure 5-7.)

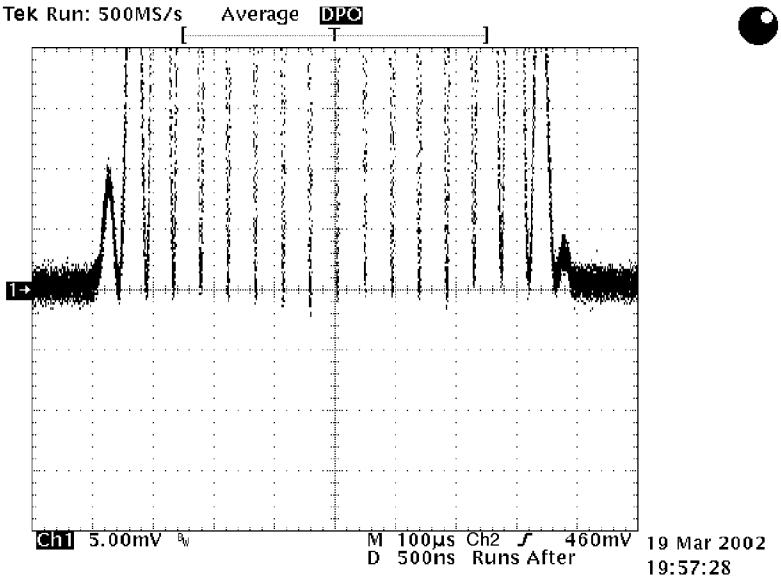



**Figure 5-7: Adjusting the baseline of the modulated 20T pulse signal**

10. Move the BNC cable from the upper CH 1 connector to the upper CH 2 connector on the AVG7 Generator module.

11. Adjust C704B and C735A so that the baseline of the modulated 20T pulse signal is flat.

12. Move the BNC cable from the upper CH 2 connector to the upper CH 3 connector on the AVG7 Generator module.

13. Adjust C604B and C635A so that the baseline of the modulated 20T pulse signal is flat.

# Frequency Response Adjustment

## Preparation

To perform the frequency response adjustment, you must first remove the top cover of the TG700 mainframe. (See page 1-15, *Top Cover*.)

After you have removed the top cover, find the variable resistors and capacitors on the AVG7 circuit board. (See Figure 5-8.)

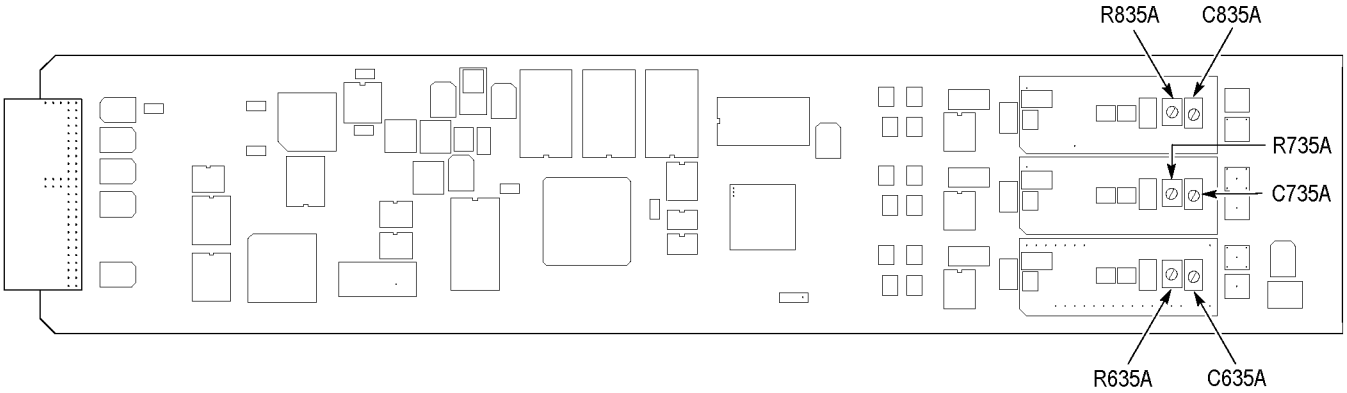



**Figure 5-8: Location of the variable resistors and capacitors for the frequency response adjustment**

## Procedure

***WARNING.*** *To avoid serious injury, do not touch exposed connectors or components when operating the TG700 mainframe with the top cover removed. Dangerous potentials exist at several points within the TG700 mainframe.*

1. Use the two 75 Ω BNC cable, peak detector head, and BNC female-to-female connector to connect the upper CH 1 connector on the AVG7 Generator module to the +INPUT connector on the peak detector amplifier. (See Figure 5-9.)
2. Use the 75 Ω BNC cable to connect the OUTPUT connector on the peak detector amplifier to the CH 1 input connector on the oscilloscope. (See Figure 5-9.)
3. Use the 75 Ω BNC cable and the 75 Ω feed-through termination to connect the BLACK 1 connector on the test signal generator to the CH 2 input connector on the oscilloscope. (See Figure 5-9.)

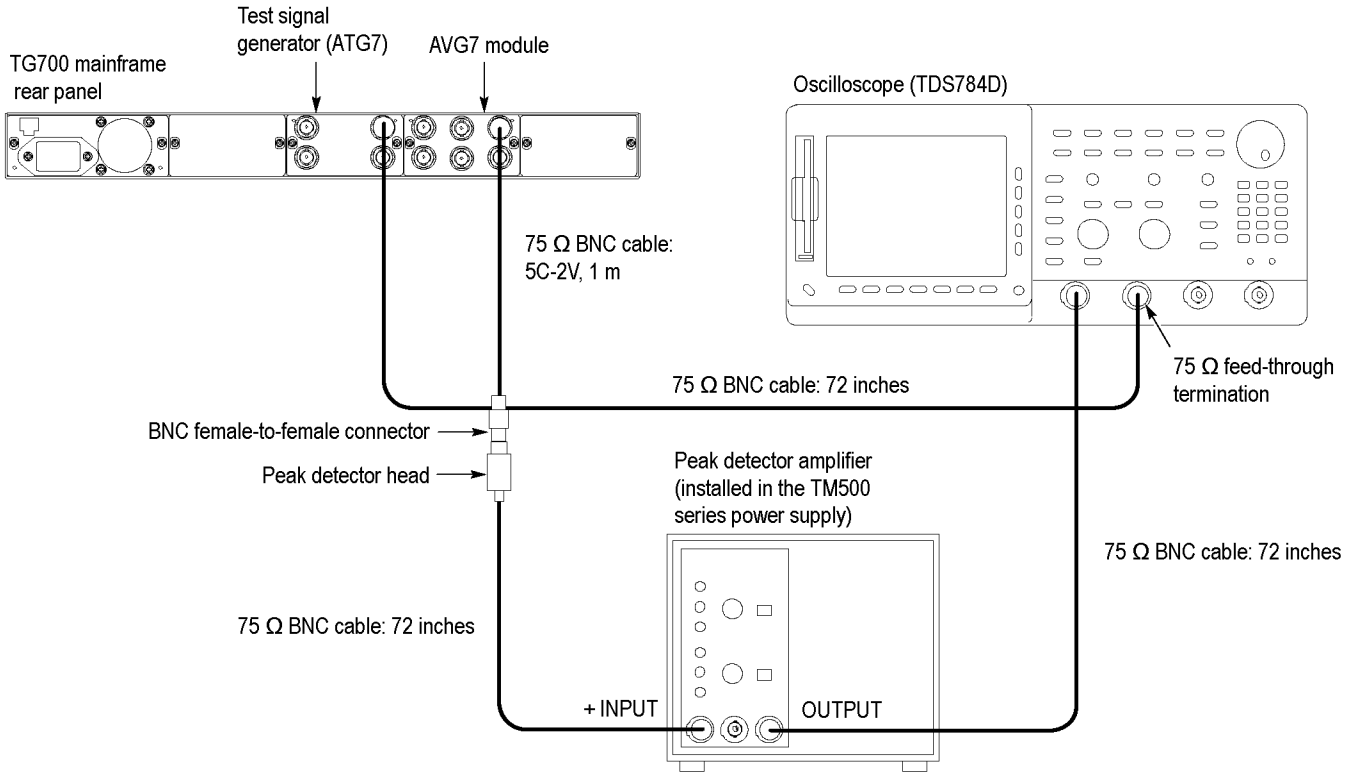



**Figure 5-9: Equipment connection for adjusting the frequency response**

4. Set the oscilloscope settings as indicated below:

| | |
|---|---|
| Vertical scale | CH 1: 2 mV/div, CH 2: 1.00 V/div |
| Bandwidth | 20 MHz (CH 1) |
| Horizontal scale | 2 ms/div |
| Trigger position | 10% |
| Trigger source | CH 2 |
| Trigger type | Edge |
| Acquire menu | Peak Detect |

5. Set the test signal generator (ATG7 module) settings as indicated below:

| | |
|---|---|
| Output selection | BLACK 1 |
| Signal format | NTSC |
| Test signal | Field Reference |

6. Press the **MODULE**, **FORMAT**, and **FRONT PANEL ENABLE** buttons simultaneously, and then release the **MODULE** and **FORMAT** buttons to re-start the instrument in Factory mode.
7. Select the 525 GBR signal format as follows:
   a. Press the **MODULE** button to display the **AVG7** main menu.
   b. Press the **FORMAT** button to select **525 GBR**, and then press the **ENTER** button.
   c. Press the **COLOR BAR** button.
8. Select the DAC Test calibration signal as follows:
   a. Press the up (▲) or down (▼) arrow button to select **CALIBRATION**.
   b. Press the left (◄) or right (►) arrow button to select **DAC Test**, and then press the **ENTER** button.
   c. Press the **ENTER** button again to confirm the signal output.
9. Select the Sync ON All Channels mode as follows:
   a. Press the up (▲) or down (▼) arrow button to select **VIDEO**, and then press the **ENTER** button to access the VIDEO submenu.
   b. Press the up (▲) or down (▼) arrow button to select **GBR SYNC**.
   c. Press the left (◄) or right (►) arrow button to select **Sync ON All Channels**, and then press the **ENTER** button.
10. Locate variable capacitors C835A, C735A, and C635A, and variable resistors R835A, R735A, and R635A on the AVG7 circuit board. (See Figure 5-8.)
11. Turn the LEVEL knob on the peak detector amplifier so that the green LED lights.
12. Adjust C835A so that the signal amplitudes of 500 kHz and 5 MHz are at the same level. (See Figure 5-10.)

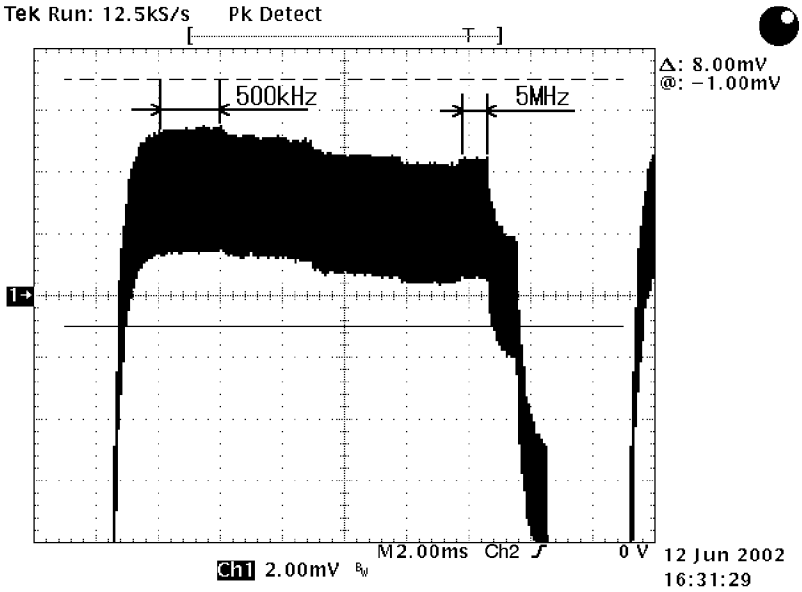



**Figure 5-10: Adjusting the signal amplitudes**

**13.** Adjust R835A so that the signal amplitudes from 500 kHz to 5 MHz are at the same level. (See Figure 5-10.)

**14.** Readjust C835A and R835A so that the differences of the signal amplitudes from 500 kHz to 5 MHz are within 2 mV.

**15.** Move the BNC cable from the upper CH 1 connector to the upper CH 2 connector on the AVG7 Generator module.

**16.** Adjust C735A so that the signal amplitudes of 500 kHz and 5 MHz are at the same level.

**17.** Adjust R735A so that the signal amplitudes from 500 kHz to 5 MHz are at the same level.

**18.** Readjust C735A and R735A so that the differences of the signal amplitudes from 500 kHz to 5 MHz are within 2 mV.

**19.** Move the BNC cable from the upper CH 2 connector to the upper CH 3 connector on the AVG7 Generator module.

**20.** Adjust C635A so that the signal amplitudes of 500 kHz and 5 MHz are at the same level.

**21.** Adjust R635A so that the signal amplitudes from 500 kHz to 5 MHz are at the same level.

**22.** Readjust C635A and R635A so that the differences of the signal amplitudes from 500 kHz to 5 MHz are within 2 mV.

## Interchannel Delay Adjustment

### Preparation

To perform the interchannel adjustment, you must first remove the top cover of the TG700 mainframe. (See page 1-15, *Top Cover*.)

After you have removed the top cover, find the variable capacitors on the AVG7 circuit board. (See Figure 5-11.)

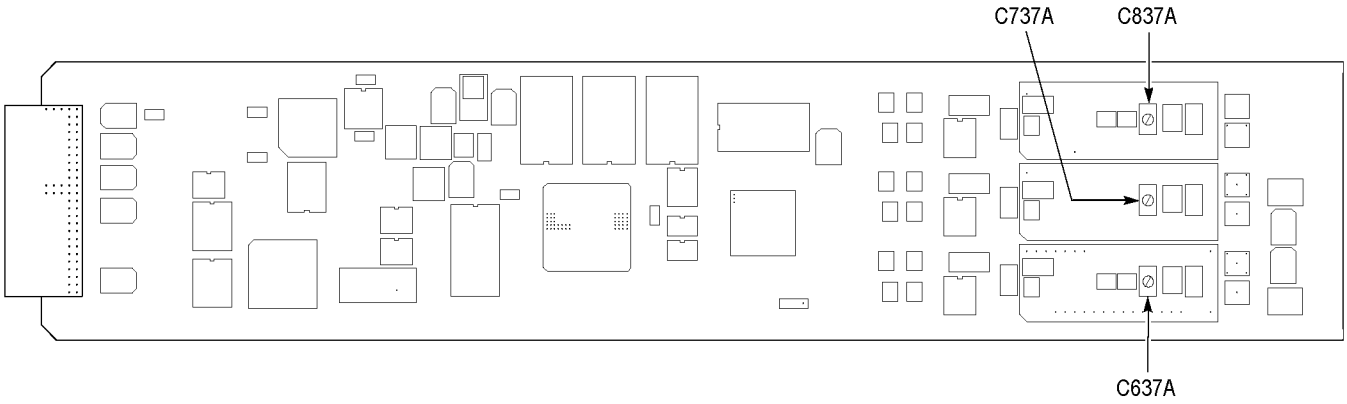



**Figure 5-11: Location of the variable capacitors for the interchannel delay adjustment**

### Procedure

***WARNING.*** *To avoid serious injury, do not touch exposed connectors or components when operating the TG700 mainframe with the top cover removed. Dangerous potentials exist at several points within the TG700 mainframe.*

1. Use the 75 Ω BNC cable and the 75 Ω signal adapter to connect the upper CH 1 connector on the AVG7 Generator module to the CH 1 input connector on the oscilloscope. (See Figure 5-12.)
2. Use the 75 Ω BNC cable and the 75 Ω signal adapter to connect the upper CH 2 connector on the AVG7 Generator module to the CH 2 input connector on the oscilloscope. (See Figure 5-12.)
3. Use the 75 Ω BNC cable and the 75 Ω feed-through termination to connect the BLACK 1 connector on the test signal generator to the CH 3 input connector on the oscilloscope. (See Figure 5-12.)

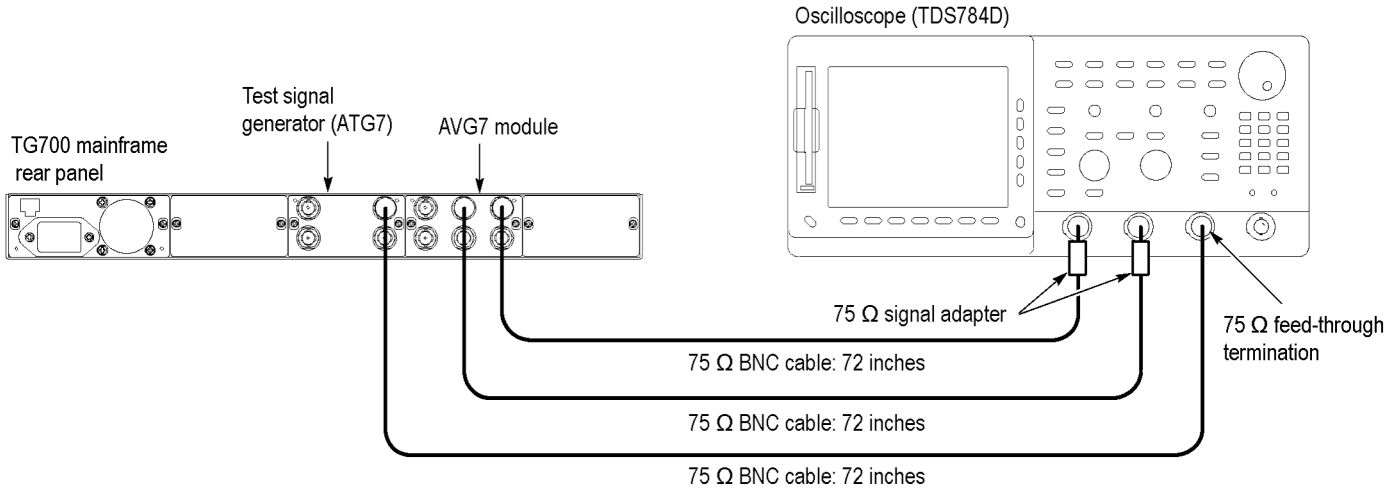



**Figure 5-12: Equipment connection for adjusting the interchannel delay**

4. Set the oscilloscope settings as indicated below:

| | |
|---|---|
| Vertical scale | CH 1 and CH 2: 5 mV/div, CH 3: 1.00 V/div |
| Bandwidth | 250 MHz (CH 1 and CH 2) |
| Vertical offset | 0 mV (CH 1 and CH 2) |
| Horizontal scale | 20 µs/div |
| Horizontal delay time | 50 ns/div |
| Delayed runs time | 6.760 µs (Delayed Only) |
| Trigger position | 50% |
| Trigger source | CH 3 |
| Trigger type | Edge |
| Acquire menu | Average 8 |
| | Repetitive Signal: OFF |
| CH 3 WAVEFORM | OFF |

5. Set the test signal generator (ATG7 module) settings as indicated below:

| | |
|---|---|
| Output selection | BLACK 1 |
| Signal format | NTSC |
| Test signal | Field Reference |

6. Use the CH 2 vertical position knob on the oscilloscope to align the CH 2 trace to the CH 1 trace with no signal input.

7. Press the **MODULE**, **FORMAT**, and **FRONT PANEL ENABLE** buttons simultaneously, and then release the **MODULE** and **FORMAT** buttons to restart the instrument in Factory mode. Continue holding down the **FRONT PANEL ENABLE** button until the "TG700 Startup with Factory Mode." message appears.

8. Select the DAC Test calibration signal as follows:
   a. Press the **MODULE** button to display the **AVG7** main menu.
   b. Press the up (▲) or down (▼) arrow button to select **CALIBRATION**.
   c. Press the left (◄) or right (►) arrow button to select **DAC Test**, and then press the **ENTER** button.
   d. Press the **ENTER** button again to confirm the signal output.
9. Select the Sync ON All Channels mode as follows:
   a. Press the up (▲) or down (▼) arrow button to select **VIDEO**, and then press the **ENTER** button to access the VIDEO submenu.
   b. Press the up (▲) or down (▼) arrow button to select **GBR SYNC**.
   c. Press the left (◄) or right (►) arrow button to select **Sync ON All Channels**, and then press the **ENTER** button.
10. Adjust R756A so that the CH 2 blanking level is aligned to the CH 1 blanking level.
11. Move the BNC cable from the CH 2 connector to the CH 3 connector on the AVG7 Generator module.
12. Adjust R656A so that the CH 3 blanking level is aligned to the CH 1 blanking level.
13. Change the oscilloscope settings as follows:

| | |
|---|---|
| Vertical offset | –150 mV (CH 1 and CH 2) |
| Horizontal delay time | 2 ns/div |
| Delayed runs time | 6.224 µs (Delayed Only) |

14. Check the time delay between the CH 1 and CH 3 signals and then perform the following steps:
   a. If the CH 1 signal is delayed from the CH 3 signal, move the BNC cable from the CH 3 connector to the CH 2 connector on the AVG7 Generator module.
   b. If the CH 3 signal is delayed from the CH 1 signal, move the BNC cable from the CH 1 connector to the CH 2 connector on the AVG7 Generator module.
15. Using the most delayed signal as a reference, adjust the following variable capacitors so that the other signals are delayed within 0.5 ns from the most delayed signal:

| | |
|---|---|
| CH 1 output | C837A |
| CH 2 output | C737A |
| CH 3 output | C637A |

## Frequency Response Confirmation

After you have performed the group delay adjustment, be sure to check that the frequency response meets the specifications.

**Procedure**

1. Use the equipment connection and controls from the frequency response adjustment. (See page 5-13.)
2. Check that the differences of each signal amplitude from 500 kHz to 5 MHz are less than or equal to 2 mV. If necessary, readjust the following variable resistors and capacitors:

| | |
|---|---|
| CH 1 output | C835A and R835A |
| CH 2 output | C735A and R735A |
| CH 3 output | C635A and R637A |

## Interchannel Delay Confirmation

After you have performed the group delay adjustment, be sure to check that the interchannel delay meets the specifications.

**Procedure**

1. Use the equipment connection and controls from the interchannel adjustment. (See page 5-17.)
2. Check that the time delay among the channel outputs is less than or equal to 1 ns. If necessary, readjust the following variable capacitors:

| | |
|---|---|
| CH 1 output | C837A |
| CH 2 output | C737A |
| CH 3 output | C637A |

# AVG7 Analog Video Generator Maintenance

This section contains instructions and procedures for maintaining the AVG7 Generator module. Before following these procedures, read *Maintenance for Generators and Modules*. (See page xix.)

The following information can be found in this section:

- Removal and Replacement (See page 5-22.)
- Troubleshooting (See page 5-24.)

If the instrument does not function properly, troubleshooting and corrective measures should be taken immediately to prevent additional problems.

***NOTE.*** *Contact your local Tektronix representative for information on where to return your instrument if it requires repair during the warranty period.*

# AVG7 Analog Video Generator Removal and Replacement

This section contains the instructions on how you can remove and replace the customer replaceable parts of the AVG7 Generator module.

## Tools Required

The following tools are required to perform the removal and replacement procedures:

**Table 5-2: Required tools for removal and replacement of AVG7 Analog Video Generator**

| Name | Description | Tektronix part number |
|---|---|---|
| Screwdriver handle | Accepts Phillips-driver bits | |
| #1 Phillips tip | Phillips-driver bit for #1 size screw heads | |
| #2 Phillips tip | Phillips-driver bit for #2 size screw heads | |
| Nut driver, 14 mm | Special nut driver for removing the BNC connectors of the AVG7 module | 003-A041-00 |

## Replacing the Rear-Panel Connectors and Chassis

It is usually not necessary to replace the rear-panel connectors or chassis. However, if a connector or chassis becomes damaged, you can replace it.

### Replacing the Rear-Panel Connectors

Perform the following procedure to replace the rear-panel connector:

1. Use the *Removing a Module* section to remove the AVG7 Generator module from the mainframe. (See page 1-41, *Removing a Module*.)
2. Disconnect the cables at J830A (upper CH 1), J830B (lower CH 1), J730A (upper CH 2), J730B (lower CH 2), J630A (upper CH 3), and J630B (lower CH 3) on the AVG7 circuit board.
3. Use the 14 mm nut driver to remove the nut securing the damaged connector to the chassis. Pull the connector away.
4. Perform steps 2 and 3 in reverse order to replace the connector.

## Replacing the Chassis

Perform the following procedure to replace the chassis:

1. Use the 14 mm nut driver to remove the nuts from each of the rear-panel connectors.
2. Use a screwdriver with a #2 Phillips tip to remove the five screws securing the AVG7 circuit board to the chassis.
3. Lift the circuit board up and away from the chassis, and then place it on a static free surface.
4. Set the replacement chassis on a firm, flat, static-free work surface.
5. Carefully place the circuit board in place on the chassis.
6. Use a screwdriver with a #2 Phillips tip to install the five screws securing the circuit board to the chassis.
7. Apply the rear panel to the chassis, and then install all the rear-panel connectors to the chassis.

# AVG7 Analog Video Generator Troubleshooting

This section contains instructions and procedures for troubleshooting the AVG7 Generator module. These procedures will help you decide whether it is necessary to replace your module.

## Equipment Required

The equipment listed in the following table is required for troubleshooting.

**Table 5-3: Equipment required for AVG7 Analog Video generator troubleshooting**

| Equipment description | Minimum requirements/example |
|---|---|
| Screwdriver handle | Accept Phillips-driver bits |
| #1 Phillips tip | Phillips-driver bit for #1 size screw heads |
| TG700 mainframe | A TG700 mainframe that is functioning correctly |

## Backing Up the Instrument Settings

Before you begin the troubleshooting procedures, create a preset to save your instrument settings as follows:

1. Press the **MODULE** button until the mainframe main menu (TG700: PRESET) appears.
2. Press the **ENTER** button to access the PRESET submenu.
3. Press the up (▲) or down (▼) arrow button to select **SAVE**.
4. Press the left (◄) or right (►) arrow button to select a preset number to save instrument settings.
5. Press the **ENTER** button to save the current instrument settings to the new preset.

After the problem is solved, recall the preset you created.

## Troubleshooting Trees

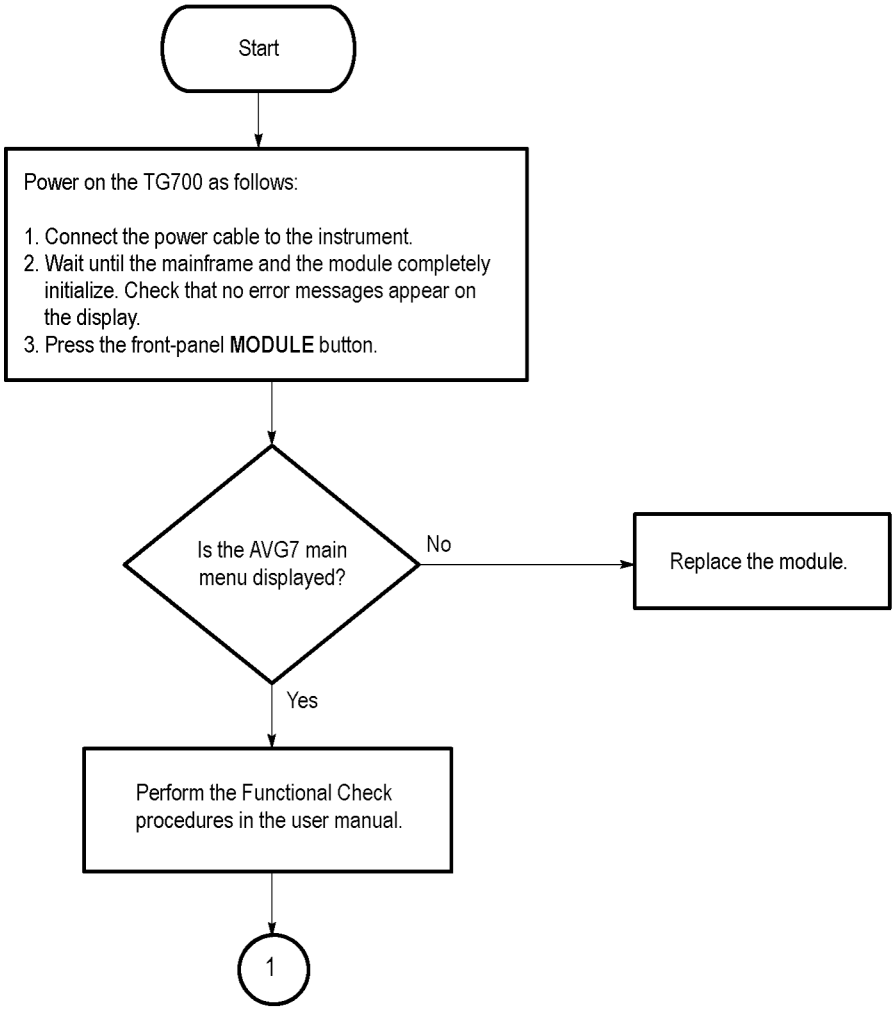

Start
Power on the TG700 as follows:
1. Connect the power cable to the instrument.
2. Wait until the mainframe and the module completely initialize. Check that no error messages appear on the display.
3. Press the front-panel MODULE button.
Is the AVG7 main menu displayed?
No
Replace the module.
Yes
Perform the Functional Check procedures in the user manual.
1

**Figure 5-13: Troubleshooting procedure (1)**

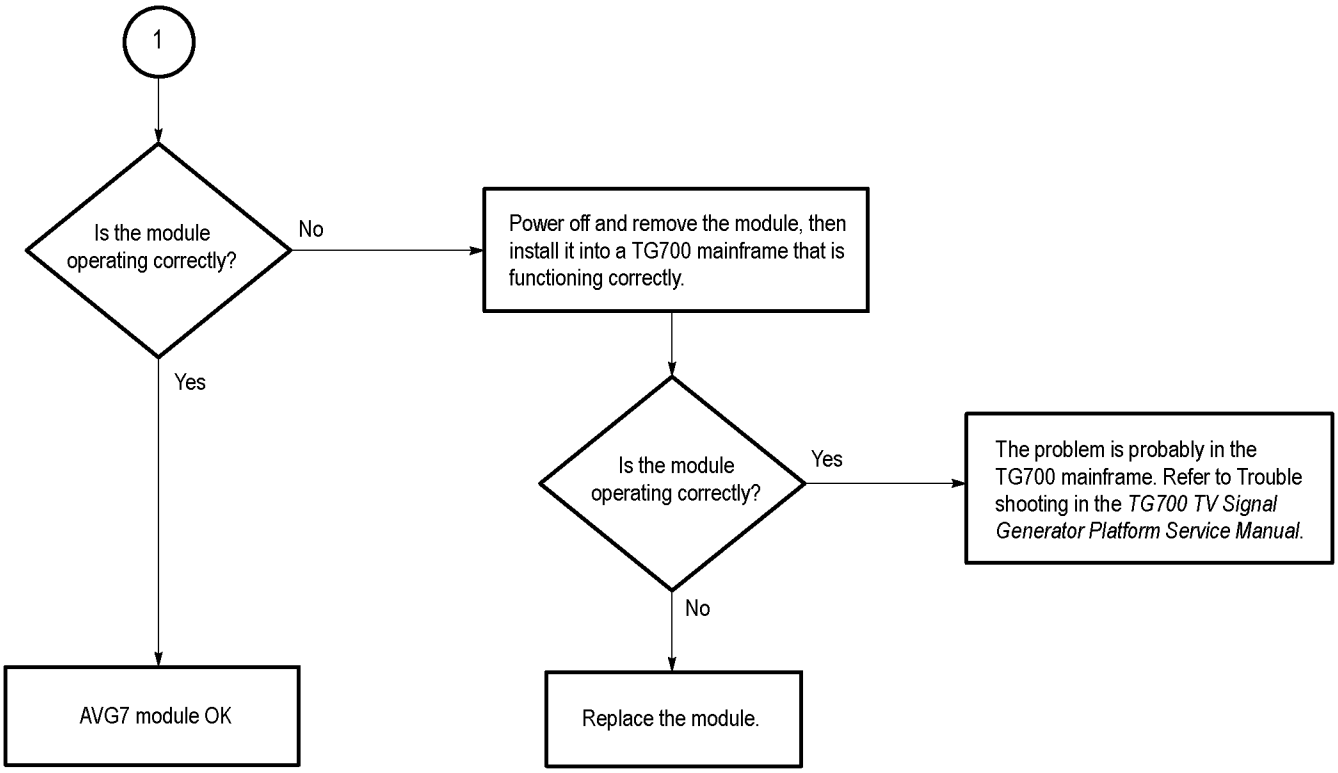

1
Is the module operating correctly?
No
Power off and remove the module, then install it into a TG700 mainframe that is functioning correctly.
Yes
Is the module operating correctly?
Yes
The problem is probably in the TG700 mainframe. Refer to Trouble shooting in the TG700 TV Signal Generator Platform Service Manual.
No
AVG7 module OK
Replace the module.

**Figure 5-14: Troubleshooting procedure (2)**

# AVG7 Analog Video Generator Diagram

The following figure shows the AVG7 Generator module and how it interconnects with the TG700 TV Signal Generator Platform.

Diagrams showing mainframe component interconnections, such as power supply and oscillator, can be found in the *TG700 Diagram* section of this manual. (See page 1-28, *TG700 Mainframe Diagrams*.)

A block diagram of the AVG7 Generator module is located in the *AVG7 Theory of Operation* section. (See page 5-1.)

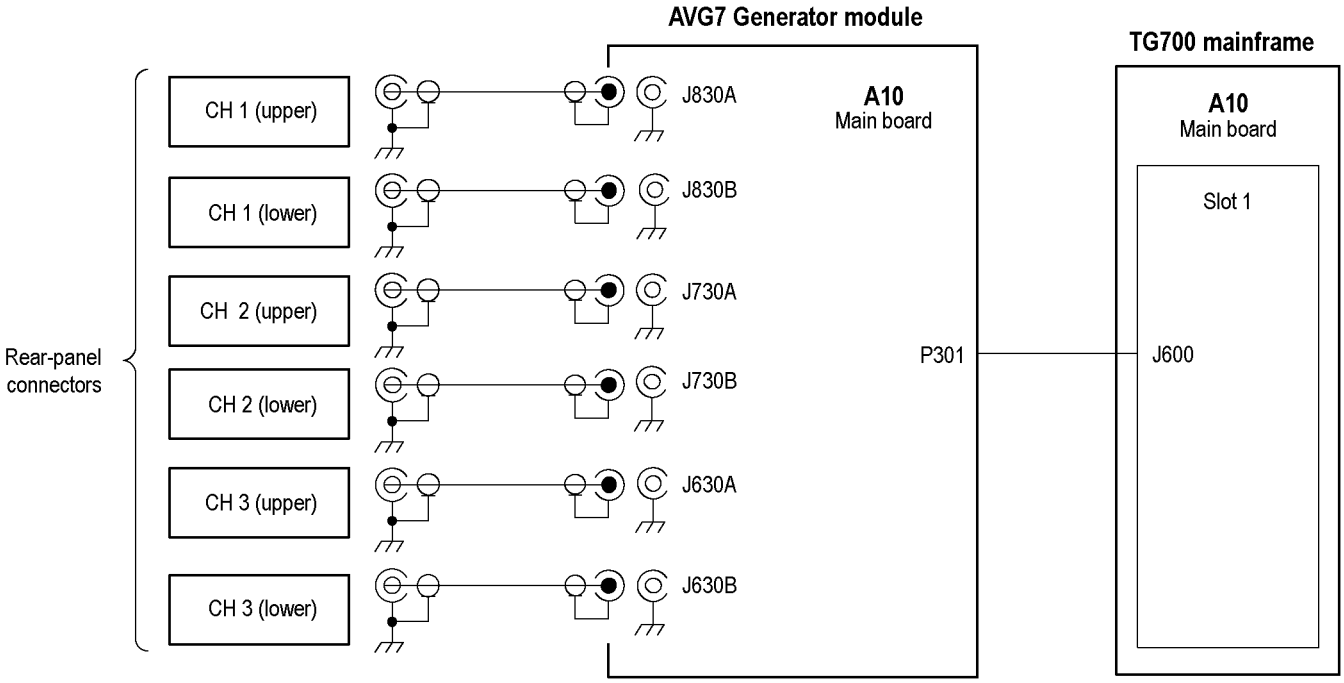



**Figure 5-15: AVG7 Generator module connections**

# AVG7 Analog Video Generator Replaceable Parts List

This section contains a list of the replaceable modules for the AVG7 Generator module. Use this list to identify and order replacement parts. For parts ordering or servicing information, see *Parts Ordering Information* or *Module Servicing* in the *TG700 Mainframe Replaceable Parts List* section of this manual. (See page 1-31, *TG700 Mainframe Replaceable Parts List*.)

## Abbreviations

Abbreviations conform to American National Standard ANSI Y1.1-1972.

### Table 5-4: AVG7 Analog Video Generator – replaceable parts

| Fig. & index number | Tektronix part number | Serial no. effective | Serial no. discont'd | Qty | Name & description |
|---|---|---|---|---|---|
| 5-16- | 116-A017-00 | | | 1 | EXCHANGE MODULE:AVG7 |
| 5-16-1 | 441-A269-02 | | | 1 | CHASSIS,MODULE AGL7:ASSY |
| -2 | 333-A453-00 | | | 1 | PANEL,REAR:AVG7,AL |
| -3 | 214-4946-00 | | | 2 | SPRING,CONICAL:VXI MOUNTING SCREW,0.26 MM SUS304,5.4 MML |
| -4 | 213-1129-01 | | | 2 | SCREW,MACHINE:M2.5X11MM L,PAN HD,STL,N1 PL,CROSS REC & SLOTTED |
| -5 | 348-A128-00 | | | 2.5 CM | SHLD GASKET,ELEK:FINGER TYPE,5.1MM LX6.4MM W,BE-CU [97-645-02] |
| -6 | 174-B851-00 | | | 6 | CABLE ASSY,RF:75OHM COAX(RG179),5.5CM L,BNC TO MCX |
| -7 | 211-A245-01 | | | 5 | SCREW,MACHINE:M3X6MM L,PNH,STL,NI PL,CROSS REC,W/KOGATAMARU&LOCK WASHER |
| -8 | 334-1378-03 | | | 1 | MARKER,IDENT:MKD SERIAL NO. |
| | | | **STANDARD ACCESSORIES** | | |
| | 075-0986-XX | | | 1 | MANUAL,TECH:MODULE INSTALLATION INSTRUCTIONS |
| | 063-3939-XX | | | 1 | KIT: SOFTWARE LIBRARY, DOCUMENTATION DVD |
| | | | **OPTIONAL ACCESSORIES** | | |
| | 003-A041-00 | | | 1 | NUTDRIVER,BOX:14MM HEX,BNC RETAINING NUT, MODIFIED 19MM |

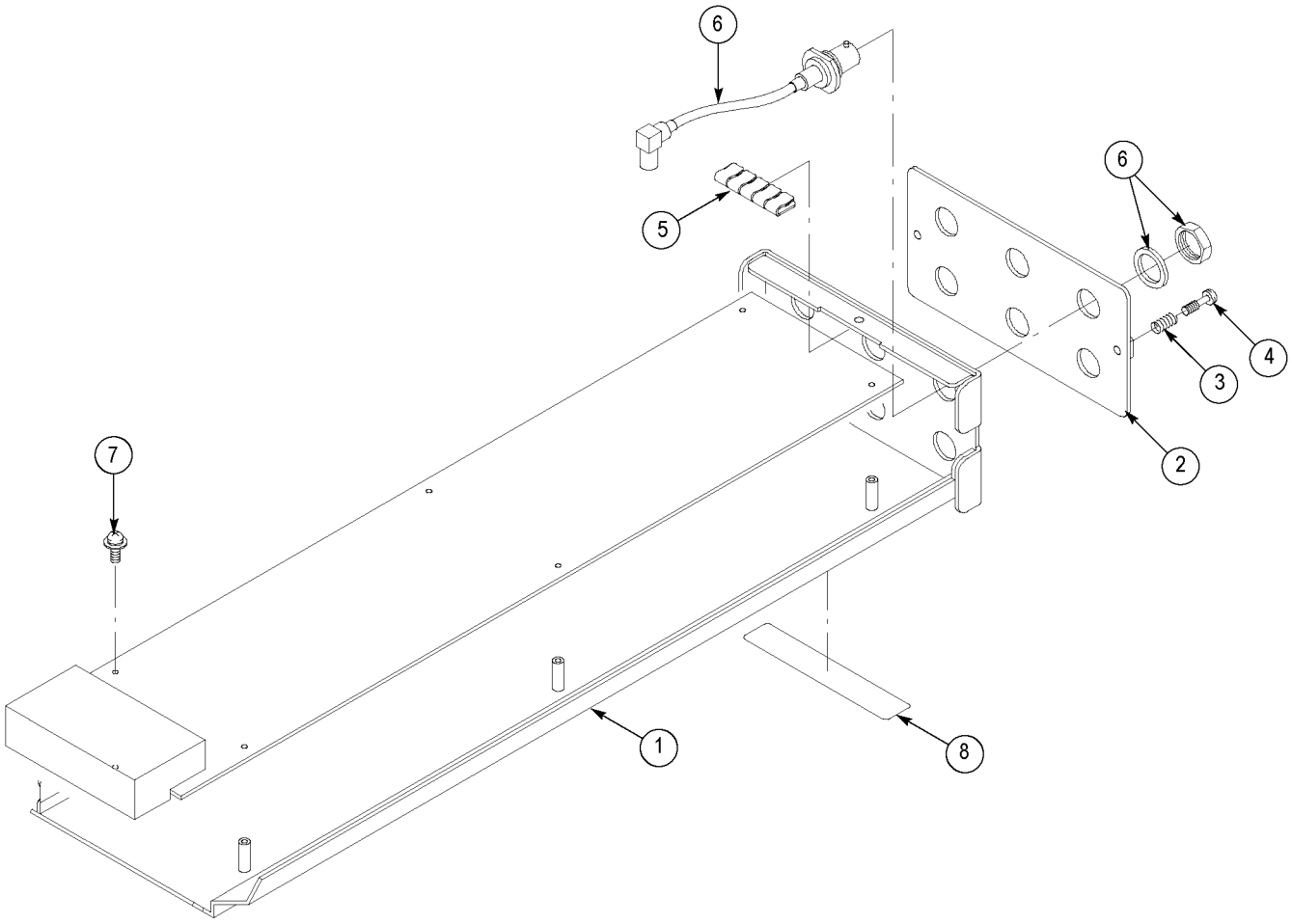



**Figure 5-16: AVG7 Generator module exploded view**

# AWVG7 Analog Wideband Video Generator

# AWVG7 Analog Wideband Video Generator Theory of Operation

This section describes the basic operation of the major circuit blocks in the AWVG7 Generator module.

**Bus Interface** This block provides the communication between the mainframe and the module circuit.

**Line Memory** Line memory holds the actual sample points which define a digital signal.

**Address Generator** This block consists of a frame delay, an MPU interface, a sequencer, an SDRAM controller, and a blanking data generator. It interfaces the Frame Memory and the Line Memory and controls the output sequence of the video data in these memories.

**Frame Memory** Frame memory contains a series of pointers that control the order the video lines stored in the Line Memory are used to produce digital signals.

**Overlay Controller** This block consists of an MPU interface and an overlay controller. It inserts data from the Overlay Memory into the Line Memory data stream to create circular patterns, ID text, and logo.

**Overlay Memory** Overlay memory generates timings to multiplex the line memory data and the overlay data used for a circle, ID text, and logo overlay.

**D/A Converter & Amp** This block consists of a D/A converter, two amplifiers, and a filter. It converts the digital data from the Overlay Controller to analog signal and reconstruct the signal for output.

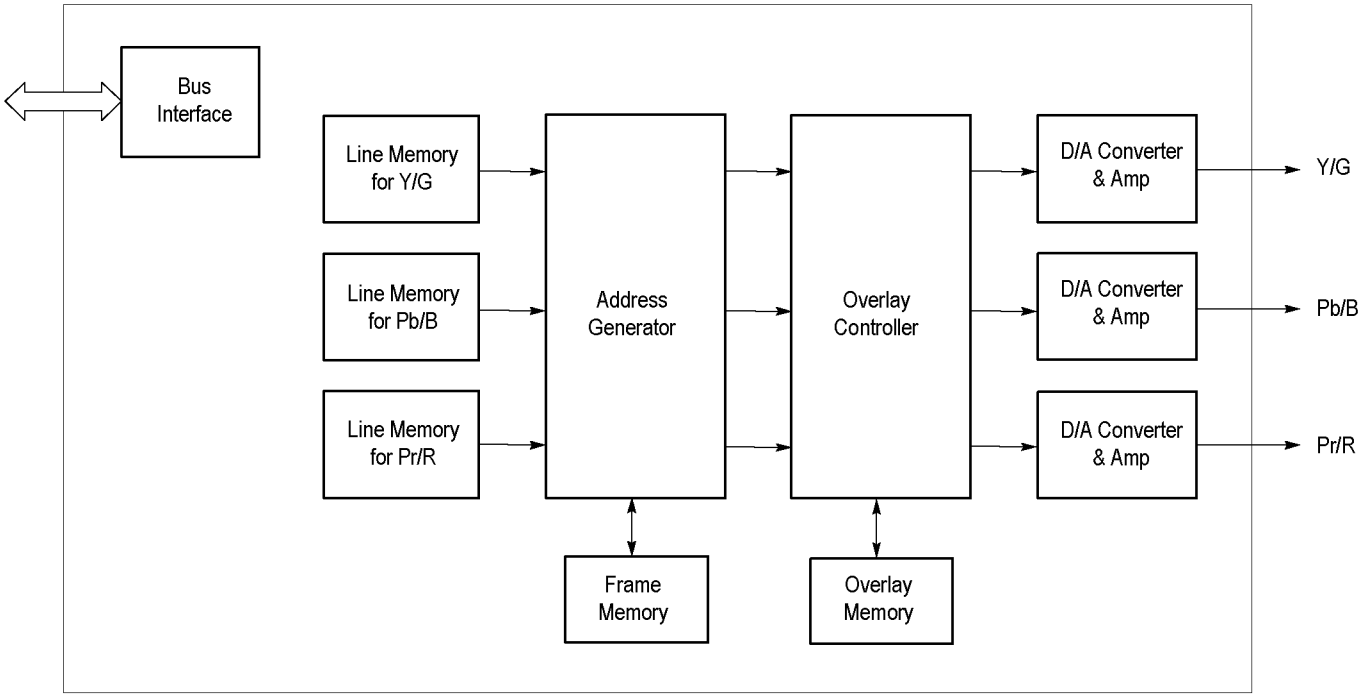



**Figure 6-1: Simplified block diagram of the AWVG7 Generator module**

# AWVG7 Analog Wideband Video Generator Adjustment Procedures

This section contains information needed to adjust the AWVG7 Generator module.

Adjustment in the AWVG7 Generator module are for the output offset and gain, frame timing and clock timing, and frequency response.

## Requirements for Adjustment

**Personnel** This procedure is only to be performed by trained service technicians.

**Warm-Up Period** The AWVG7 Generator module requires a 20 minute warm-up time in a +20 °C to +30 °C environment before it is adjusted. Adjustments done before the operating temperature has stabilized may cause errors in performance.

***WARNING.*** *To avoid potential shock, use caution when removing TG700 mainframe top cover with power connected.*

**Access** When adjusting the AWVG7 Generator module, you need to remove the top cover of the TG700 mainframe. (See page 1-15, *Top Cover*.)

***NOTE.*** *If the serial number of your instrument is B010600 and above, replace the resistor and capacitor numbers in the figures and procedures as follows:*

*R6xxx →R6xxx_1 (for example, R651A → R651A_1)*

*R7xxx → R6xxx_2 (for example, R751A → R651A_2)*

*R8xxx → R6xxx_3 (for example, R851A → R651A_3)*

*C6xxx → R6xxx_1 (for example, C604B → C604B_1)*

*C7xxx → R6xxx_2 (for example, C704B → C604B_2)*

*C8xxx → R6xxx_3 (for example, C804B → C604B_3)*

## Equipment Required

The following table lists the equipment required to adjust the output offset and gain, frame timing and clock timing, and frequency response.

**Table 6-1: Equipment required for AWVG7 Analog Wideband Video Generator adjustment procedures**

| Item | No. | Minimum requirement | Recommended equipment |
|---|---|---|---|
| TV signal generator platform | 1 | | Tektronix TG700 |
| Oscilloscope | 1 | Bandwidth: 1 GHz or higher Function: Mask testing | Tektronix TDS784D Option 2C |
| Digital multimeter | 1 | 5 1/2 digits | FLUKE 8842A |
| Peak detector amplifier | 1 | | Tektronix part number 015-0408-00 and TM500 series power supply |
| Peak detector head | 1 | | Tektronix part number 015-0413-00 |
| Probe | 2 | X 10 | Tektronix P6139A |
| 75 Ω BNC cable | 2 | Length: 72 inches | Tektronix part number 012-0159-01 |
| 75 Ω BNC cable | 1 | 5C-2V, 1 m | Canare DH5C01-S-SA |
| 75 Ω feed-through termination | 1 | | Tektronix part number 011-0103-02 |
| 75 Ω coaxial termination | 1 | | Tektronix part number 011-0102-03 |
| BNC T connector | 1 | | Tektronix part number 103-0030-00 |
| BNC female-to-dual banana adapter | 1 | | Tektronix part number 103-0090-00 |
| BNC female-to-female connector | 1 | | Canare BCJ-J |
| Flat blade screwdriver for adjusting C604B, C704B, and C804B | 1 | Bit shape: 0.8X0.35 mm | Murata KMDR060 |

## Output Offset and Gain Adjustment

### Preparation

To perform the output offset and gain adjustment, you must first remove the top cover of the TG700 mainframe. (See page 1-15, *Top Cover*.)

After you have removed the top cover, find the variable resistors on the AWVG7 circuit board. (See Figure 6-2.)

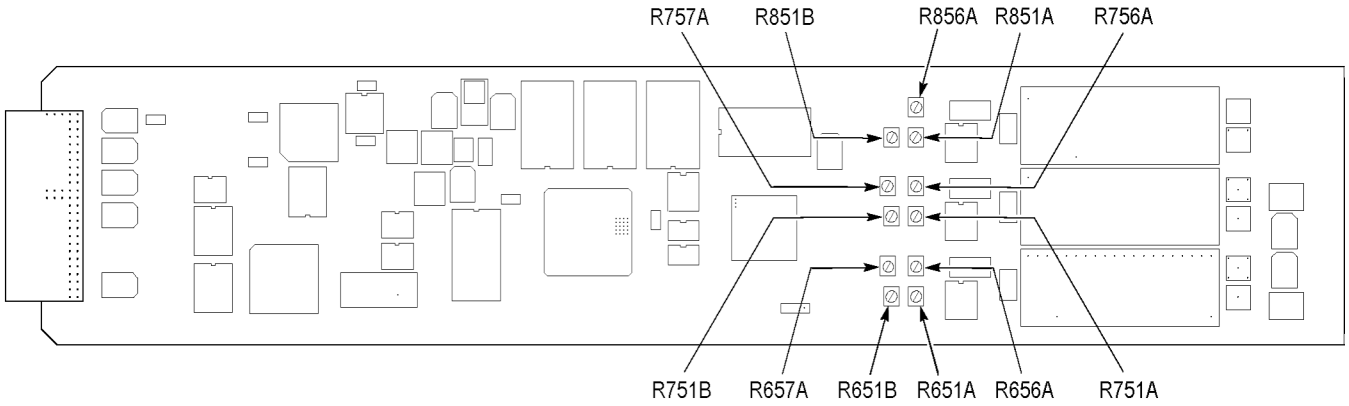



**Figure 6-2: Location of the variable resistors for the output offset and gain adjustment**

## Procedure

***WARNING.*** *To avoid serious injury, do not touch exposed connectors or components when operating the TG700 mainframe with the top cover removed. Dangerous potentials exist at several points within the TG700 mainframe.*

1. Use the 75 Ω BNC cable, BNC T connector, 75 Ω coaxial termination, and BNC female-to-dual banana adapter to connect the upper CH 1 connector on the AWVG7 Generator module to the INPUT connector on the digital multimeter. (See Figure 6-3.)

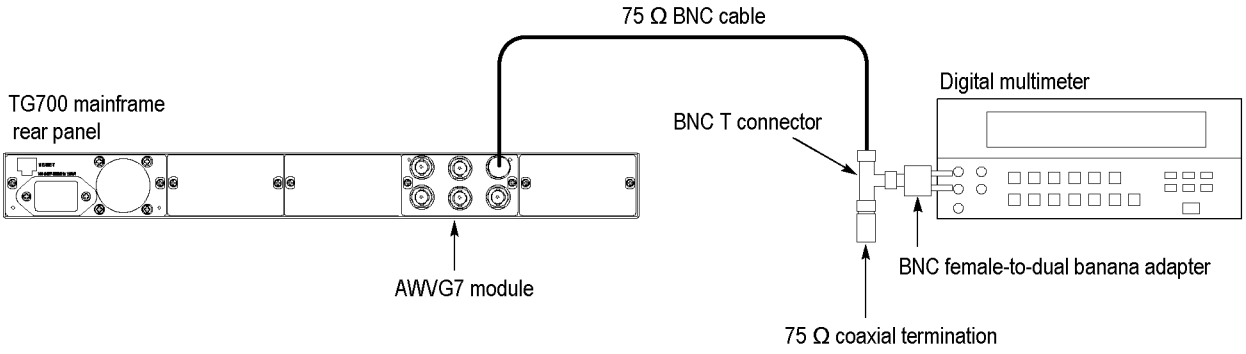



**Figure 6-3: Equipment connection for adjusting the output offset and gain**

2. Press the **MODULE**, **FORMAT**, and **FRONT PANEL ENABLE** buttons simultaneously, and then release the **MODULE** and **FORMAT** buttons to restart the instrument in Factory mode. Continue holding down the **FRONT PANEL ENABLE** button until the "TG700 Startup with Factory Mode." message appears.

3. Select the DAC Gain (GBR) : 0 mV calibration signal as follows:
   a. Press the **MODULE** button to display the **AWVG7** main menu.
   b. Press the up (▲) or down (▼) arrow button to select **CALIBRATION**.
   c. Press the left (◄) or right (►) arrow button to select **DAC Gain (GBR)**, and then press the **ENTER** button.
   d. Press the left (◄) or right (►) arrow button to select **0mV**, and then press the **ENTER** button.
4. Locate variable resistor R856A on the AWVG7 circuit board. (See Figure 6-2.)
5. Adjust R856A so that the output offset is 0 V ±1 mV.
6. Move the BNC cable from the upper CH 1 connector to the upper CH 2 connector on the AWVG7 Generator module.
7. Locate variable resistor R756A on the AWVG7 circuit board. (See Figure 6-2.)
8. Adjust R756A so that the output offset is 0 V ±1 mV.
9. Move the BNC cable from the upper CH 2 connector to the upper CH 3 connector on the AWVG7 Generator module.
10. Locate variable resistor R656A on the AWVG7 circuit board. (See Figure 6-2.)
11. Adjust R656A so that the output offset is 0 V ±1 mV.
12. Move the BNC cable from the upper CH 3 connector to the upper CH 1 connector on the AWVG7 Generator module.
13. Press the left (◄) or right (►) arrow button to select **700.397mV**, and then press the **ENTER** button.
14. Locate variable resistors R851A (coarse) and R851B (fine) on the AWVG7 circuit board. (See Figure 6-2.)
15. Adjust R851A and R851B so that the output gain is 700.4 mV ±1 mV.
16. Move the BNC cable from the upper CH 1 connector to the upper CH 2 connector on the AWVG7 Generator module.
17. Locate variable resistors R751A (coarse) and R751B (fine) on the AWVG7 circuit board. (See Figure 6-2.)
18. Adjust R751A and R751B so that the output gain is 700.4 mV ±1 mV.
19. Move the BNC cable from the upper CH 2 connector to the upper CH 3 connector on the AWVG7 Generator module.
20. Locate variable resistors R651A (coarse) and R651B (fine) on the AWVG7 circuit board. (See Figure 6-2.)

21. Adjust R651A and R651B so that the output gain is 700.4 mV ±1 mV.
22. Move the BNC cable from the upper CH 3 connector to the upper CH 2 connector on the AWVG7 Generator module.
23. Select the DAC Gain (YPbPr) : 0 mV calibration signal for CH 2 and CH 3 as follows:
    a. Press the **CANCEL** button to display the **CALIBRATION** menu.
    b. Press the left (◄) or right (►) arrow button to select **DAC Gain (YPbPr)**, and then press the **ENTER** button.
    c. Press the left (◄) or right (►) arrow button to select **0mV**, and then press the **ENTER** button.
24. Locate variable resistor R757A on the AWVG7 circuit board. (See Figure 6-2.)
25. Adjust R757A so that the output offset is 0 V ±1 mV.
26. Move the BNC cable from the upper CH 2 connector to the upper CH 3 connector on the AWVG7 Generator module.
27. Locate variable resistor R657A on the AWVG7 circuit board. (See Figure 6-2.)
28. Adjust R657A so that the output offset is 0 V ±1 mV.

## Frame Timing and Clock Timing Adjustments

***NOTE.*** *Instruments serial numbered B010600 or above do not require this adjustment.*

### Preparation

To perform the frame timing and clock timing adjustment, you must first remove the top cover of the TG700 mainframe. (See page 1-15, *Top Cover*.)

After you have removed the top cover, find the test points on the AWVG7 circuit board. (See Figure 6-4.)

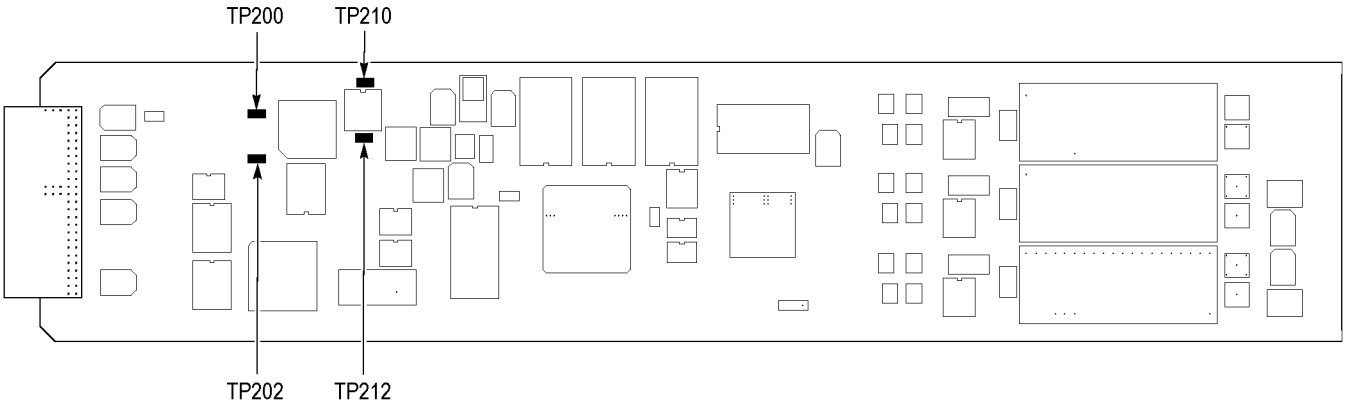



**Figure 6-4: Location of the test points for the frame timing and clock timing adjustment**

## Procedure

***WARNING.*** *To avoid serious injury, do not touch exposed connectors or components when operating the TG700 mainframe with the top cover removed. Dangerous potentials exist at several points within the TG700 mainframe.*

1. Attach the two P6139A probes to the oscilloscope CH 1 and CH 2 inputs.
2. Locate test points TP200, TP202, TP210, and TP212 on the AWVG7 circuit board. (See Figure 6-4.)
3. Connect the probe tip from the oscilloscope CH 1 input to TP200.
4. Connect the probe tip from the oscilloscope CH 2 input to TP202.
5. Set the oscilloscope settings as indicated below:

| | |
|---|---|
| Vertical scale | CH 1: 500 mV/div, CH 2: 1V/div |
| Vertical position | –2.0 div |
| Vertical offset | CH 1: 3.3 V, CH 2: 0 V |
| Horizontal scale | 5 ns/div |
| Horizontal length | 500 |
| Trigger position | 0% |
| Trigger source | CH 1 |
| Trigger type | Edge |
| Acquisition mode | Average 4 |
| Acquisition mode | Relative Signal OFF |
| Measure High-Low setup | Min-Max |

6. Check that both the CH 1 and CH 2 waveforms are displayed stably, and then turn off the CH 1 display.

7. Select **Frame 0.0 nsec** from the Frame Timing calibration menu as follows:
   a. Press the **MODULE** button to display the **AWVG7** main menu.
   b. Press the up (▲) or down (▼) arrow button to select **CALIBRATION**.
   c. Press the left (◄) or right (►) arrow button to select **Frame Timing**, and then press the **ENTER** button.
   d. Press the left (◄) or right (►) arrow button to select **Frame 0.0 nsec**, and then press the **ENTER** button.
8. Save the CH 2 waveform on the oscilloscope in **Ref1**, and then display the saved waveform.
9. Select **Delay** from the Measure menu, and then set the oscilloscope to measure the time delay between the Ref1 and CH 2 waveforms.
10. Press the up (▲) or down (▼) arrow button to select **2.0 ns**.
11. While seeing the Delay Timing value on the oscilloscope, press the left (◄) or right (►) arrow button to adjust the delay value to 2.0 ns.
12. Press the up (▲) or down (▼) arrow button to select **10.0 ns**.
13. While seeing the Delay Timing value on the oscilloscope, press the left (◄) or right (►) arrow button to adjust the delay value to 10.0 ns.
14. Press the up (▲) or down (▼) arrow button to select **22.0 ns**.
15. While seeing the Delay Timing value on the oscilloscope, press the left (◄) or right (►) arrow button to adjust the delay value to 22.0 ns.
16. Press the **CANCEL** button to return the CALIBRATION menu.
17. Press the left (◄) or right (►) arrow button to select **Clock Timing**, and then press the **ENTER** button.
18. Move CH 1 probe from TP200 to TP202. Move Ch 2 probe from TP210 to TP212.
19. Press the up (▲) or down (▼) arrow button to select **Clock 0.0 nsec**, and then the **ENTER** button.
20. Save the waveform on the oscilloscope in **Ref1**.
21. Press the up (▲) or down (▼) arrow button to select **2.0 ns**.
22. While seeing the Delay Timing value on the oscilloscope, press the left (◄) or right (►) arrow button to adjust the delay value to 2.0 ns.
23. Save the waveform on the oscilloscope in **Ref1**, and then press the up (▲) or down (▼) arrow button to select **10.0 ns**.
24. While seeing the Delay Timing value on the oscilloscope, press the left (◄) or right (►) arrow button to adjust the delay value to 8.0 ns.

25. Save the waveform on the oscilloscope in **Ref1**, and then press the up (▲) or down (▼) arrow button to select **22.0 ns**.
26. While seeing the Delay Timing value on the oscilloscope, press the left (◄) or right (►) arrow button to adjust the delay value to 12.0 ns.
27. Press the **CANCEL** button to return to the CALIBRATION menu.

## Frequency Response Adjustment

### Preparation

To perform the frequency response adjustment, you must first remove the top cover of the TG700 mainframe. (See page 1-15, *Top Cover*.)

After you have removed the top cover, find the variable capacitors on the AWVG7 circuit board. (See Figure 6-5.)

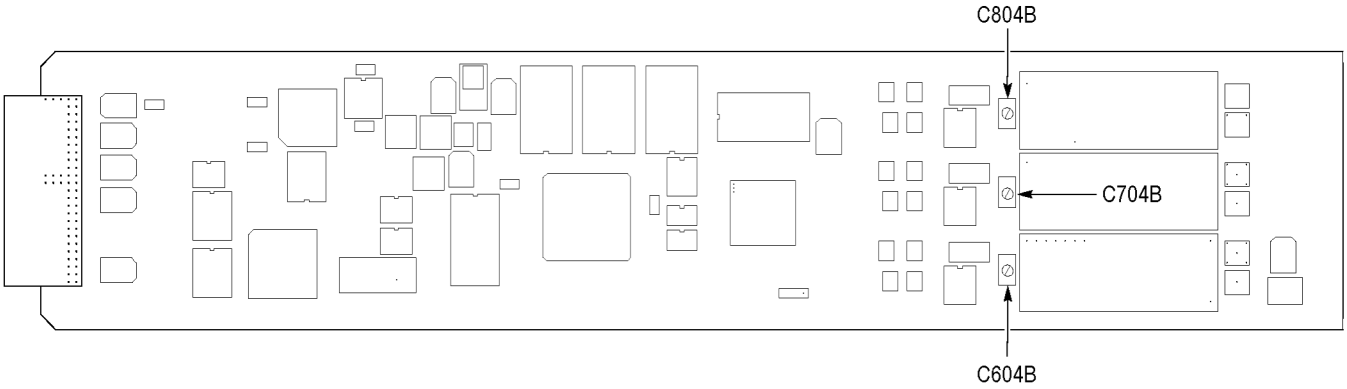



**Figure 6-5: Location of the variable capacitors for the frequency response adjustment**

## Procedure

***WARNING.*** *To avoid serious injury, do not touch exposed connectors or components when operating the TG700 mainframe with the top cover removed. Dangerous potentials exist at several points within the TG700 mainframe.*

1. Use the two 75 Ω BNC cables, peak detector head, and BNC female-to-female connector to connect the upper CH 1 connector on the AWVG7 Generator module to the +INPUT connector on the peak detector amplifier. (See Figure 6-6.)
2. Use the 75 Ω BNC cable to connect the OUTPUT connector on the peak detector amplifier to the CH 1 input connector on the oscilloscope. (See Figure 6-6.)

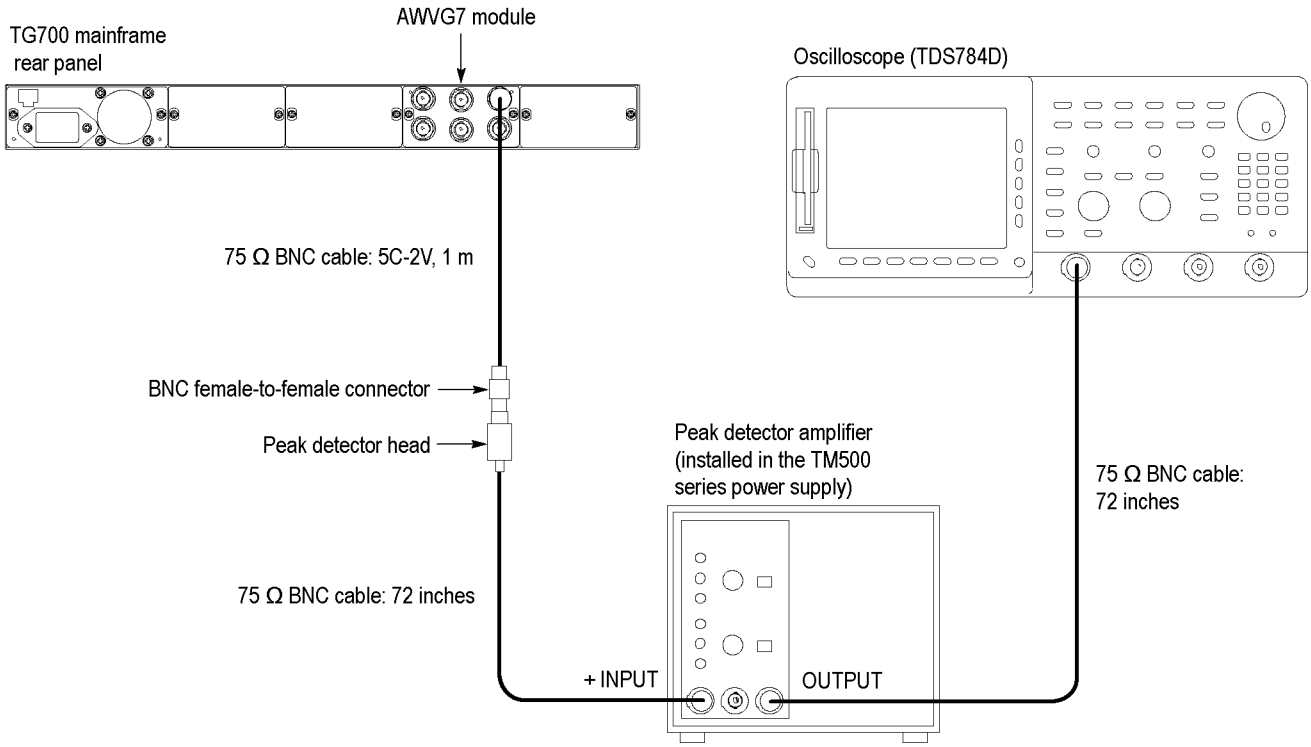



**Figure 6-6: Equipment connection for adjusting the frequency response**

3. Set the oscilloscope settings as indicated below:

| | |
|---|---|
| Vertical scale | CH 1: 5 mV/div |
| Bandwidth | 250 MHz |
| Horizontal scale | 5 ms/div |
| Trigger position | 10% |
| Trigger source | CH 1 |
| Trigger type | Edge |
| Trigger level | –50 mV |
| Acquire menu | Average 4 |

4. Press the **MODULE**, **FORMAT**, and **FRONT PANEL ENABLE** buttons simultaneously, and then release the **MODULE** and **FORMAT** buttons to restart the instrument in Factory mode. Continue holding down the **FRONT PANEL ENABLE** button until the "TG700 Startup with Factory Mode." message appears.

5. Select the DAC Test calibration signal as follows:

   a. Press the **MODULE** button to display the AWVG7 main menu.

   b. Press the up (▲) or down (▼) arrow button to select **CALIBRATION**.

   c. Press the left (◄) or right (►) arrow button to select **DAC Test**, and then press the **ENTER** button.

   d. Press the **ENTER** button again to confirm the signal output.

6. Locate variable capacitors C804B, C704B, and C604B on the AWVG7 circuit board. (See Figure 6-5.)

7. Turn the LEVEL knob on the peak detector amplifier so that the green LED lights.

8. Adjust C804B so that the amplitude changes from 500 kHz to 20 MHz are at a minimum. (See Figure 6-7.)

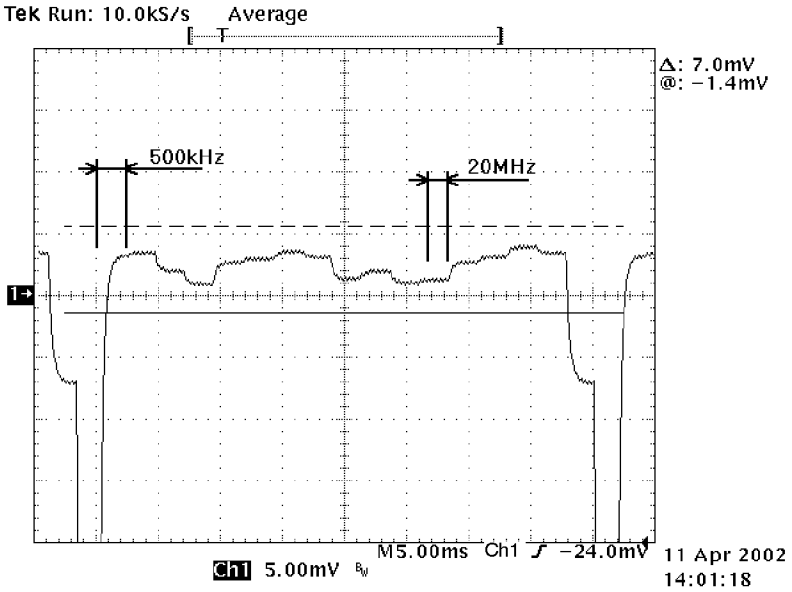



**Figure 6-7: Minimizing the amplitude changes**

**9.** Move the BNC cable from the upper CH 1 connector to the upper CH 2 connector on the AWVG7 Generator module.

**10.** Adjust C704B so that the amplitude changes from 500 kHz to 20 MHz are at a minimum.

**11.** Move the BNC cable from the upper CH 2 connector to the upper CH 3 connector on the AWVG7 Generator module.

**12.** Adjust C604B so that the amplitude changes from 500 kHz to 20 MHz are at a minimum.

# AWVG7 Analog Wideband Video Generator Maintenance

This section contains instructions and procedures for maintaining the AWVG7 Generator module.

The following information can be found in this section:

- Removal and Replacement (See page 6-15.)
- Troubleshooting (See page 6-17.)

If the instrument does not function properly, troubleshooting and corrective measures should be taken immediately to prevent additional problems.

***NOTE.*** *Contact your local Tektronix representative for information on where to return your instrument if it requires repair during the warranty period.*

# AWVG7 Analog Wideband Video Generator Removal and Replacement

This section contains the instructions on how you can remove and replace the customer replaceable parts of the AWVG7 Generator module.

## Tools Required

The following tools are required to perform the removal and replacement procedures:

**Table 6-2: Required tools for removal and replacement of AWVG7 Analog Wideband Video Generator**

| Name | Description | Tektronix part number |
|---|---|---|
| Screwdriver handle | Accepts Phillips-driver bits | |
| #1 Phillips tip | Phillips-driver bit for #1 size screw heads | |
| #2 Phillips tip | Phillips-driver bit for #2 size screw heads | |
| Nut driver, 14 mm | Special nut driver for removing the BNC connectors of the AWVG7 module | 003-A041-00 |

## Replacing the Rear-Panel Connectors and Chassis

It is usually not necessary to replace the rear-panel connectors or chassis. However, if a connector or chassis becomes damaged, you can replace it.

### Replacing the Rear-Panel Connectors

Perform the following procedure to replace the rear-panel connector:

1. Use the *Removing a Module* section to remove the AWVG7 Generator module from the mainframe. (See page 1-41, *Removing a Module*.)
2. Disconnect the cables at J830A (upper CH 1), J830B (lower CH 1), J730A (upper CH 2), J730B (lower CH 2), J630A (upper CH 3), and J630B (lower CH 3) on the AWVG7 circuit board.
3. Use the 14 mm nut driver to remove the nut securing the damaged connector to the chassis. Pull the connector away.
4. Perform steps 2 and 3 in reverse order to replace the connector.

## Replacing the Chassis

Perform the following procedure to replace the chassis:

1. Use the 14 mm nut driver to remove the nuts from each of the rear-panel connectors.
2. Use a screwdriver with a #2 Phillips tip to remove the five screws securing the AWVG7 circuit board to the chassis.
3. Lift the circuit board up and away from the chassis, and then place it on a static free surface.
4. Set the replacement chassis on a firm, flat, static-free work surface.
5. Carefully place the circuit board in place on the chassis.
6. Use a screwdriver with a #2 Phillips tip to install the five screws securing the circuit board to the chassis.
7. Apply the rear panel to the chassis, and then install all the rear-panel connectors to the chassis.

# AWVG7 Analog Wideband Video Generator Troubleshooting

This section contains instructions and procedures for troubleshooting the AWVG7 Generator module. These procedures will help you decide whether it is necessary to replace your module.

If the TG700 mainframe does not boot up or if the display is not working, refer to the *TG700 Mainframe Troubleshooting* section in this manual. (See page 1-24, *TG700 Mainframe Troubleshooting*.)

## Equipment Required

The equipment listed in the following table is required for troubleshooting.

**Table 6-3: Equipment required for AWVG7 Analog Wideband Video Generator troubleshooting**

| Equipment description | Minimum requirements/example |
|---|---|
| Screwdriver handle | Accept Phillips-driver bits |
| #1 Phillips tip | Phillips-driver bit for #1 size screw heads |
| TG700 mainframe | A TG700 mainframe that is functioning correctly |

## Backing Up the Instrument Settings

Before you begin the troubleshooting procedures, create a preset to save your instrument settings as follows:

1. Press the **MODULE** button until the mainframe main menu (TG700: PRESET) appears.
2. Press the **ENTER** button to access the PRESET submenu.
3. Press the up (▲) or down (▼) arrow button to select **SAVE**.
4. Press the left (◄) or right (►) arrow button to select a preset number to save instrument settings.
5. Press the **ENTER** button to save the current instrument settings to the new preset.

After the problem is solved, recall the preset you created.

## Troubleshooting Trees

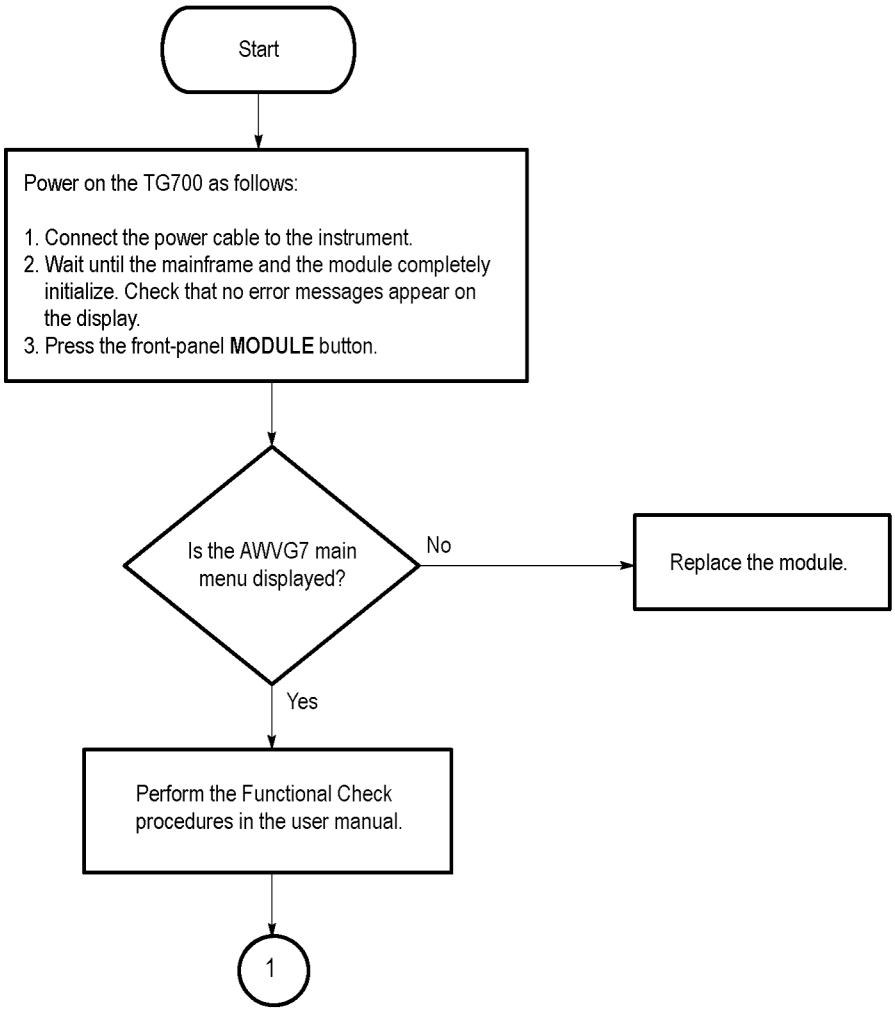

Start
Power on the TG700 as follows:
1. Connect the power cable to the instrument.
2. Wait until the mainframe and the module completely initialize. Check that no error messages appear on the display.
3. Press the front-panel MODULE button.
Is the AWVG7 main menu displayed?
No
Replace the module.
Yes
Perform the Functional Check procedures in the user manual.
1

**Figure 6-8: Troubleshooting procedure (1)**

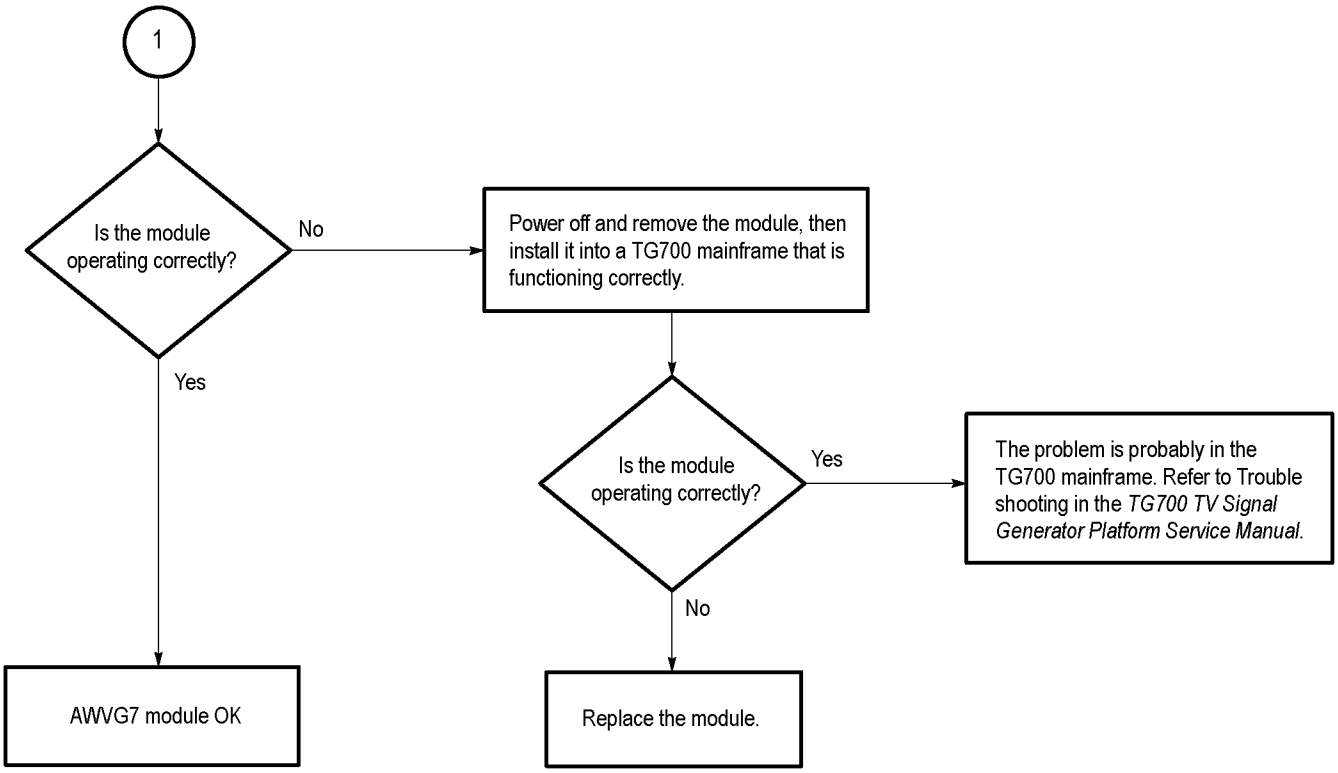

1
Is the module operating correctly?
No
Power off and remove the module, then install it into a TG700 mainframe that is functioning correctly.
Yes
Is the module operating correctly?
Yes
The problem is probably in the TG700 mainframe. Refer to Trouble shooting in the TG700 TV Signal Generator Platform Service Manual.
No
AWVG7 module OK
Replace the module.

**Figure 6-9: Troubleshooting procedure (2)**

# AWVG7 Analog Wideband Video Generator Diagram

The following figure shows the AWVG7 Generator module and how it interconnects with the TG700 TV Signal Generator Platform.

Diagrams showing mainframe component interconnections, such as power supply and oscillator, can be found in the *TG700 Diagram* section of this manual. (See page 1-28, *TG700 Mainframe Diagrams*.)

A block diagram of the AWVG7 Generator module is located in the *Theory of Operation* section. (See page 6-1.)

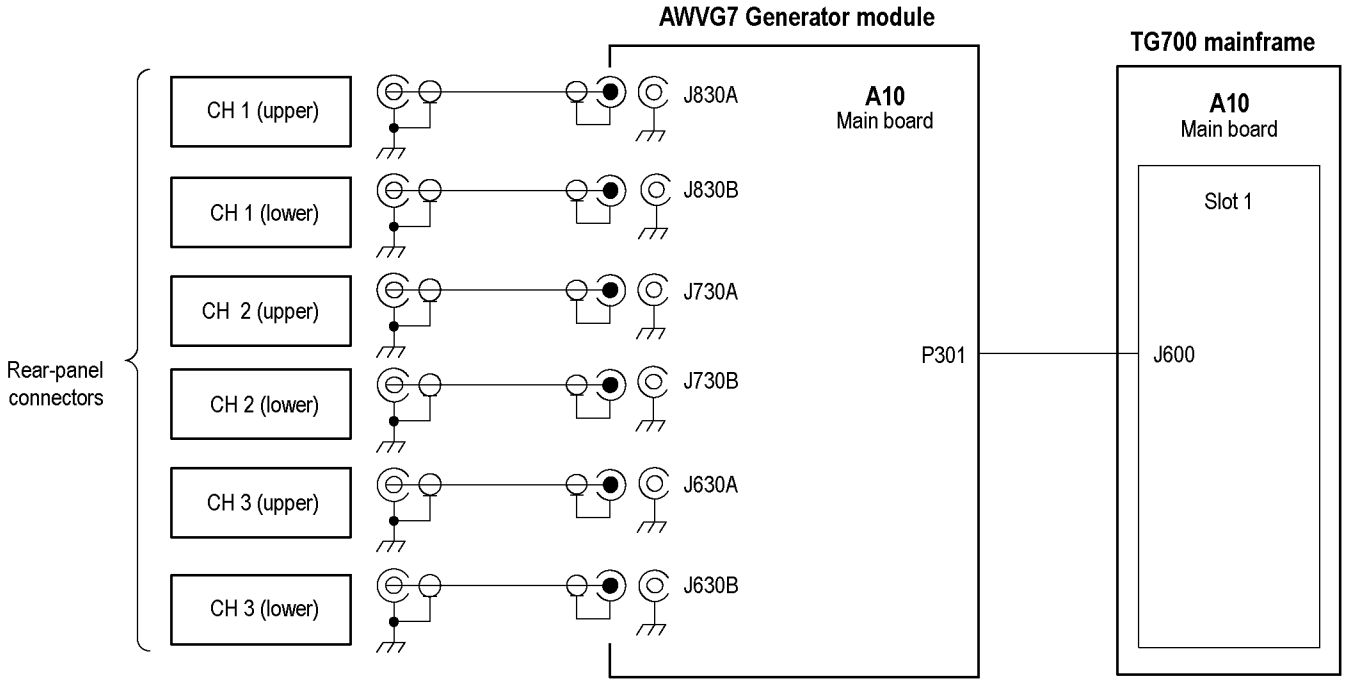



**Figure 6-10: AWVG7 Generator module connections**

# AWVG7 Analog Wideband Video Generator Replaceable Parts List

This section contains a list of the replaceable modules for the AWVG7 Generator module. Use this list to identify and order replacement parts. For parts ordering or servicing information, see *Parts Ordering Information* or *Module Servicing* in the *TG700 Mainframe Replaceable Parts List* section of this manual. (See page 1-31, *TG700 Mainframe Replaceable Parts List*.)

## Abbreviations

Abbreviations conform to American National Standard ANSI Y1.1-1972.

### Table 6-4: AWVG7 Analog Wideband Video Generator – replaceable parts

| Fig. & index number | Tektronix part number | Serial no. effective | Serial no. discont'd | Qty | Name & description |
|---|---|---|---|---|---|
| 6-11- | 116-A018-00 | | | 1 | EXCHANGE MODULE:AWVG7 |
| 6-11-1 | 441-A269-02 | | | 1 | CHASSIS,MODULE |
| -2 | 333-A454-00 | | | 1 | PANEL,REAR,AL,AWVG7 |
| -3 | 214-4946-00 | | | 2 | SPRING,CONICAL:VXI MOUNTING SCREW,0.26 MM SUS304,5.4 MML |
| -4 | 213-1129-01 | | | 2 | SCREW,MACHINE:M2.5X11MM L,PAN HD,STL,N1 PL,CROSS REC & SLOTTED |
| -5 | 348-A128-00 | | | 2.5CM | SHLD GASKET,ELEK:FINGER TYPE,5.1MM LX6.4MM W,BE-CU [97-645-02] |
| -6 | 174-B851-00 | | | 6 | CABLE ASSY,RF:75OHM COAX(RG179),5.5CM L,BNC TO MCX |
| -7 | 211-A245-01 | | | 5 | SCREW,MACHINE:M3X6MM L,PNH,STL,NI PL,CROSS REC,W/KOGATAMARU&LOCK WASHER |
| -8 | 334-1378-03 | | | 1 | MARKER,IDENT:MKD SERIAL NO. |
| | | | | | **STANDARD ACCESSORIES** |
| | 075-0986-XX | | | 1 | MANUAL,TECH:MODULE INSTALLATION INSTRUCTIONS |
| | 063-3939-XX | | | 1 | KIT: SOFTWARE LIBRARY, DOCUMENTATION DVD |
| | | | | | **OPTIONAL ACCESSORIES** |
| | 003-A041-00 | | | 1 | NUTDRIVER,BOX:14MM HEX,BNC RETAINING NUT, MODIFIED 19MM |

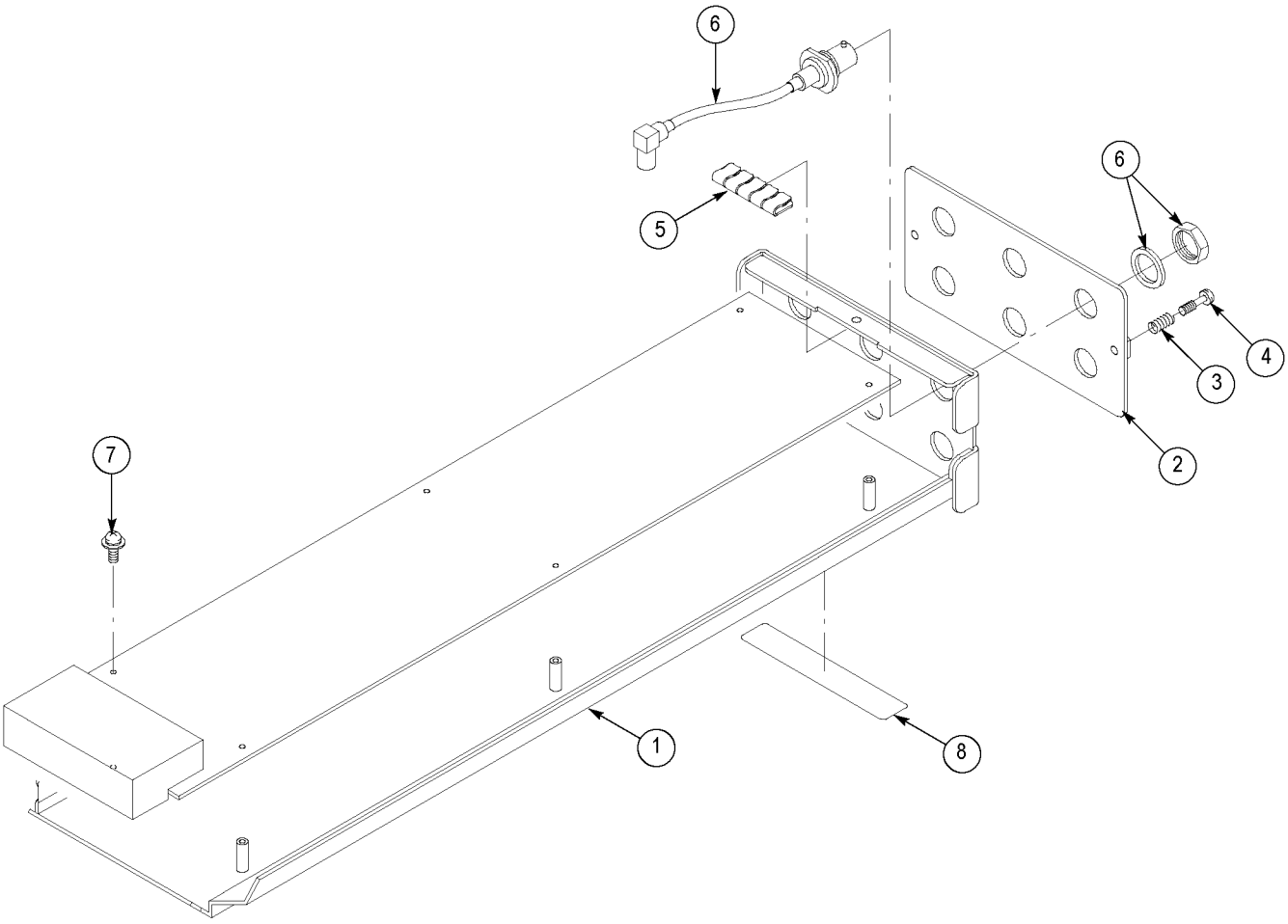



**Figure 6-11: AWVG7 Generator module exploded view**

# BG7 Black Generator

# BG7 Black Generator Theory of Operation

This section describes the basic operation of the major circuit blocks in the BG7 Generator module.

## Bus Interface

This block provides the communication between the mainframe and the module circuit.

## Sync Generator

The block creates the digital data of NTSC/PAL black burst signal or HDTV trilevel sync signal. When optional memories are added, sync generator 3 and 4 can also generate 10 field ID and NTSC/PAL color bar signals.

## D/A Converter & Amp

The block consists of a D/A converter, two amplifiers, and two filters (one is for NTSC/PAL and another is for HD). The D/A converter converts the digital data from the Sync Generator to an analog signal and reconstructs the signal for output.

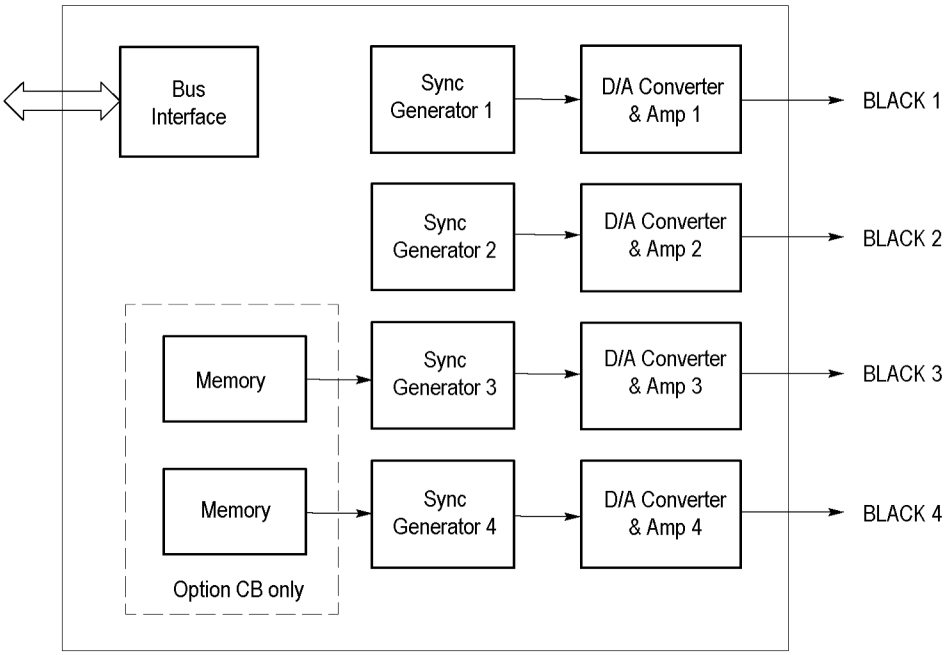



**Figure 7-1: Simplified block diagram of the BG7 Generator module**

# BG7 Black Generator Adjustment Procedures

This section contains information needed to adjust the BG7 Generator module.

Adjustment in the BG7 Generator module are for the output offset, output gain, and luminance gain.

## Requirements for Adjustment

Before doing the adjustment, note the following requirements.

### Personnel

This procedure is only to be performed by trained service technicians.

### Warm-Up Period

The BG7 Generator module requires a 20 minute warm-up time in a +20 °C to +30 °C environment before it is adjusted. Adjustments done before the operating temperature has stabilized may cause errors in performance.

### Access

When adjusting the blanking, luminance, and chrominance levels, you need to remove the top cover of the TG700 mainframe. (See page 1-15, *Top Cover*.)

## Equipment Required

The following table lists the equipment required to adjust the output offset, output gain, and luminance gain.

**Table 7-1: Equipment required for BG7 Black Generator adjustment procedures**

| Item | No. | Minimum requirement | Recommended equipment |
|---|---|---|---|
| TV signal generator platform | 1 | | Tektronix TG700 |
| Digital multimeter | 1 | 5 1/2 digits | FLUKE 8842A |
| Video measurement set | 1 | | Tektronix VM700T Option 01/11 |
| 75 Ω BNC cable | 1 | Length: 42 inches | Tektronix part number 012-0074-00 |
| 75 Ω coaxial terminator | 1 | | Tektronix part number 011-0102-03 |
| BNC T connector | 1 | | Tektronix part number 103-0030-00 |
| BNC female to dual banana adapter | 1 | | Tektronix part number 103-0090-00 |

## Output Offset and Gain Adjustment

### Preparation

To perform the output offset and gain adjustment, you must first remove the top cover of the TG700 mainframe. (See page 1-15, *Top Cover*.)

After you have removed the top cover, find the variable resistors on the BG7 circuit board. (See Figure 7-2.)

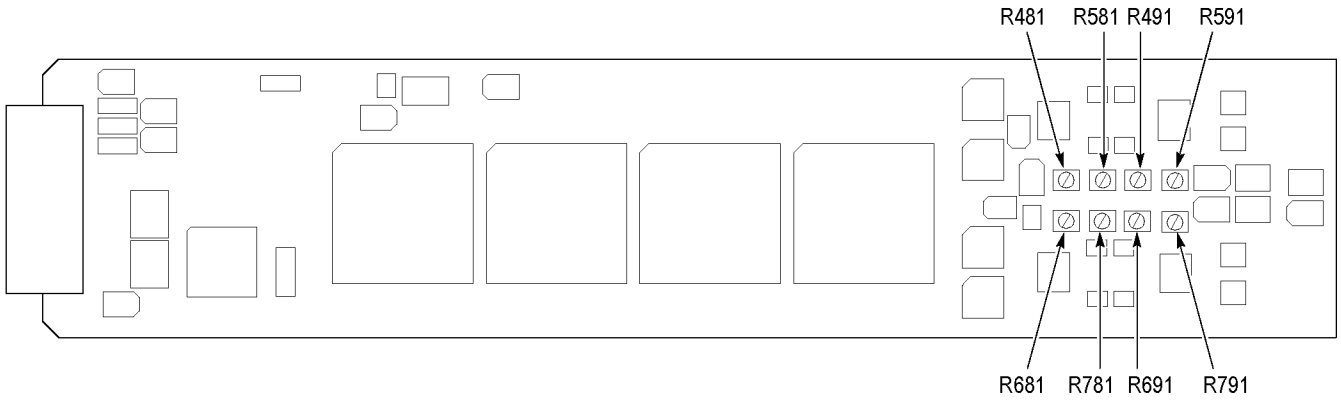



**Figure 7-2: BG7 circuit board view**

### Procedure

***WARNING.*** *To avoid serious injury, do not touch exposed connectors or components when operating the TG700 mainframe with the top cover removed. Dangerous potentials exist at several points within the TG700 mainframe.*

1. Use the 75 Ω BNC cable, BNC T connector, 75 Ω coaxial terminator, and BNC female-to-dual banana adapter to connect the BLACK 1 connector on the BG7 Generator module to the input connector on the digital multimeter. (See Figure 7-3.)

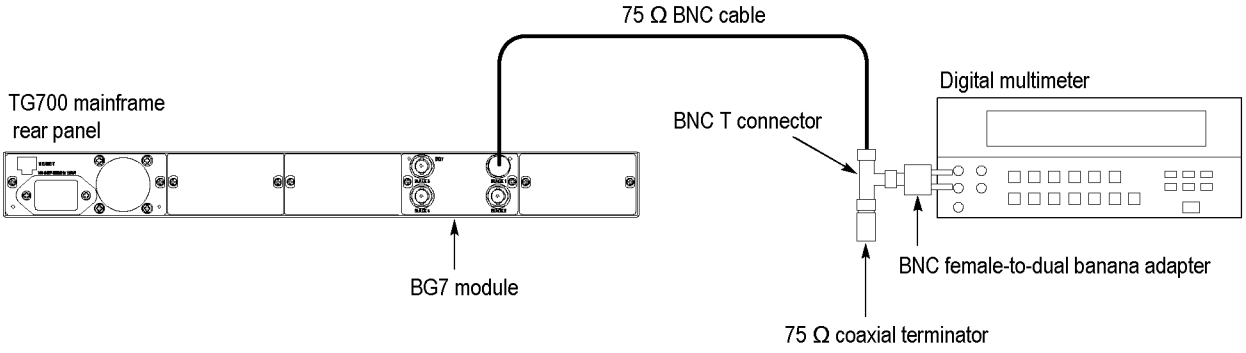



**Figure 7-3: Equipment connection for adjusting the output offset and gain**

2. Press the **MODULE**, **FORMAT**, and **FRONT PANEL ENABLE** buttons simultaneously, and then release the **MODULE** and **FORMAT** buttons to restart the instrument in Factory mode.
3. Select the DAC Offset (0V DC) calibration signal for BLACK 1 through BLACK 4 as follows:
   a. Press the **MODULE** button to display the **BG7** main menu.
   b. Press the up (▲) or down (▼) arrow button to select **CALIBRATION**.
   c. Press the left (◄) or right (►) arrow button to select **BLACK 1**, and then press the **ENTER** button.
   d. Press the left (◄) or right (►) arrow button to select **CAL : DAC Offset (0V DC)**, and then press the **ENTER** button.
   e. Press the **CANCEL** button.
   f. Repeat parts a through e of this step to select the calibration signal for BLACK 2 through BLACK 4.
4. Locate variable resistor R491 on the BG7 circuit board. (See Figure 7-2.)
5. Adjust R491 so that the output offset is 0 V ±1 mV.
6. Change the BNC cable connection from BLACK 1 connector to the BLACK 2 connector on the BG7 Generator module.
7. Locate variable resistor R591 on the BG7 circuit board. (See Figure 7-2.)
8. Adjust R591 so that the output offset is 0 V ±1 mV.
9. Change the BNC cable connection from BLACK 2 connector to the BLACK 3 connector on the BG7 Generator module.
10. Locate variable resistor R691 on the BG7 circuit board. (See Figure 7-2.)
11. Adjust R691 so that the output offset is 0 V ±1 mV.
12. Change the BNC cable connection from the BLACK 3 connector to the BLACK 4 connector on the BG7 Generator module.
13. Locate variable resistor R791 on the BG7 circuit board. (See Figure 7-2.)
14. Adjust R791 so that the output offset is 0 V ±1 mV.

**15.** Select the DAC Gain (1.000V DC) calibration signal for BLACK 1 through BLACK 4 as follows:

**a.** Press the left (◄) or right (►) arrow button to select **BLACK 1**, and then press the **ENTER** button.

**b.** Press the left (◄) or right (►) arrow button to select **CAL : DAC Gain (1.000V DC)**, and then press the **ENTER** button.

**c.** Press the **CANCEL** button.

**d.** Repeat parts a through c of this step to select the calibration signal for BLACK 2 through BLACK 4.

**16.** Locate variable resistor R481 on the BG7 circuit board. (See Figure 7-2.)

**17.** Adjust R481 so that the output gain is 1 V ±1 mV.

**18.** Change the BNC cable connection from the BLACK 1 connector to the BLACK 2 connector on the BG7 Generator module.

**19.** Locate variable resistor R581 on the BG7 circuit board. (See Figure 7-2.)

**20.** Adjust R581 so that the output gain is 1 V ±1 mV.

**21.** Change the BNC cable connection from the BLACK 2 connector to the BLACK 3 connector on the BG7 Generator module.

**22.** Locate variable resistor R681 on the BG7 circuit board. (See Figure 7-2.)

**23.** Adjust R681 so that the output gain is 1 V ±1 mV.

**24.** Change the BNC cable connection from the BLACK 3 connector to the BLACK 4 connector on the BG7 Generator module.

**25.** Locate variable resistor R781 on the BG7 circuit board. (See Figure 7-2.)

**26.** Adjust R781 so that the output gain is 1 V ±1 mV.

# Luminance Gain Adjustment (Option CB Only)

## Preparation

To perform the luminance gain adjustment, you must first remove the top cover of the TG700 mainframe. (See page 1-15, *Top Cover*.)

After you have removed the top cover, find the variable resistors on the BG7 circuit board. (See Figure 7-2.)

## Procedure

***WARNING.*** *To avoid serious injury, do not touch exposed connectors or components when operating the TG700 mainframe with the top cover removed. Dangerous potentials exist at several points within the TG700 mainframe.*

1. Use the 75 Ω BNC cable to connect the BLACK 3 connector on the BG7 Generator module to the CHAN A connector on the video measurement set. (See Figure 7-4.)
2. Use the 75 Ω coaxial terminator to terminate the other loop through to the CHAN A connector on the video measurement set.

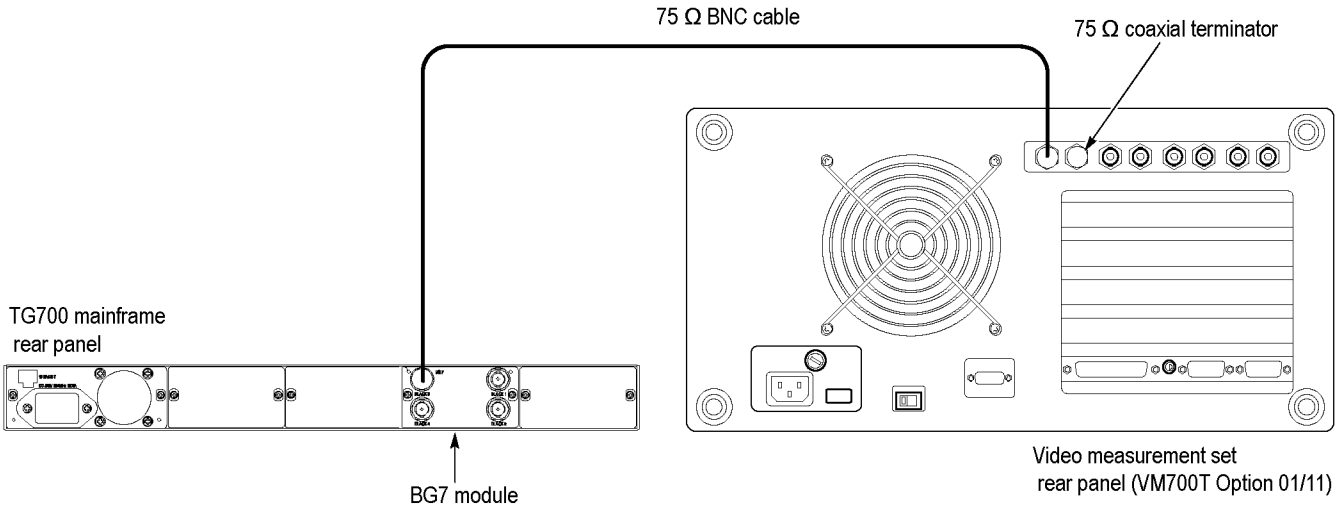



**Figure 7-4: Equipment connection for adjusting luminance gain**

3. Select the **75% Colour Bars** signal for BLACK 3 and BLACK 4 as follows:
   a. Press the **MODULE** button to display the BG7 main menu.
   b. Press the left (◄) or right (►) arrow button to select **BLACK 3**, and then press the **ENTER** button.
   c. Press the left (◄) or right (►) arrow button to select **PAL**, and then press the **ENTER** button.
   d. Press the left (◄) or right (►) arrow button to select **75% Colour Bars**, and then press the **ENTER** button.
   e. Press the **CANCEL** button twice to return the module main menu.
   f. Repeat parts b through d of this step to select the 75% Colour Bars signal for BLACK 4.
4. Press the **Measure** button on the video measurement set to open the Measure mode display.
5. Touch the **Video Standard** soft key to change the acceptable video standard for PAL.
6. In the Measure mode display, touch the **Color Bar** soft key to open the Color Bar measurement display.
7. Press the **Menu** button to display the Color Bar main menu.
8. Touch the **Average** soft key and rotate the front-panel knob to set the value to 16.
9. Locate variable resistor R681 on the BG7 circuit board. (See Figure 7-2.)
10. Adjust R681 so that the luminance gain (White) is 700 mV ±1.5 mV.
11. Verify that chrominance gain (Red) is within the range of 658.8 mV to 668.8 mV.
12. Change the BNC cable connection from the BLACK 3 connector to the BLACK 4 connector on the BG7 Generator module.
13. Locate variable resistor R781 on the BG7 circuit board. (See Figure 7-2.)
14. Adjust R781 so that the luminance gain (White) is 700 mV ±1.5 mV.
15. Verify that chrominance gain (Red) is within the range of 658.8 mV to 668.8 mV.

# BG7 Black Generator Maintenance

This section contains instructions and procedures for maintaining the BG7 Generator module. Before following these procedures, read *Maintenance for Generators and Modules*. (See page xix.)

The following information can be found in this section:

- Removal and Replacement (See page 7-9.)
- Troubleshooting (See page 7-11.)

If the instrument does not function properly, troubleshooting and corrective measures should be taken immediately to prevent additional problems.

***NOTE.*** *Contact your local Tektronix representative for information on where to return your instrument if it requires repair during the warranty period.*

# BG7 Black Generator Removal and Replacement

This section contains the instructions on how you can remove and replace the customer replaceable parts of the BG7 Generator module.

## Tools Required

The following tools are required to perform the removal and replacement procedures:

**Table 7-2: Required tools for removal and replacement of BG7 Black Generator**

| Name | Description | Tektronix part number |
|---|---|---|
| Screwdriver handle | Accepts Phillips-driver bits | |
| #1 Phillips tip | Phillips-driver bit for #1 size screws | |
| #2 Phillips tip | Phillips-driver bit for #2 size screws | |
| Nut driver, 14 mm | Special nut driver for removing the BNC connectors of the BG7 module | 003-A041-00 |

## Replacing the Rear-Panel Connectors and Chassis

It is usually not necessary to replace the rear-panel connectors or chassis. However, if a connector or chassis becomes damaged, you can replace it.

### Replacing the Rear-Panel Connectors

Perform the following procedure to replace the rear-panel connector:

1. Use the *Removing a Module* section to remove the BG7 Generator module from the mainframe. (See page 1-41, *Removing a Module*.)
2. Disconnect the cables at P830 (BLACK 1), J880 (BLACK 2), J930 (BLACK 3) and J980 (BLACK 4) on the BG7 circuit board.
3. Use the 14 mm nut driver to remove the nut securing the damaged connector to the chassis. Pull the connector away.
4. Perform steps 2 and 3 in reverse order to replace the connector.

### Replacing the Chassis

Perform the following procedure to replace the chassis:

1. Use the 14 mm nut driver to remove the nuts from each of the rear-panel connectors.
2. Use a screwdriver with a #2 Phillips tip to remove the six screws securing the BG7 circuit board to the chassis.

3. Lift the circuit board up and away from chassis, and then place it on a static free surface.
4. Set the replacement chassis on a firm, flat, static-free work surface.
5. Carefully place the circuit board in place on the chassis.
6. Use a screwdriver with a #2 Phillips tip to install the five screws securing the circuit board to the chassis.
7. Apply the rear panel to the chassis, and then install all the rear-panel connectors to the chassis.

# BG7 Black Generator Troubleshooting

This section contains instructions and procedures for troubleshooting the BG7 Generator module. These procedures will help you decide whether it is necessary to replace your module.

If the TG700 mainframe does not boot up or if the display is not working, refer to the *TG700 Mainframe Troubleshooting* section in this manual. (See page 1-24, *TG700 Mainframe Troubleshooting*.)

## Equipment Required

The equipment listed in the following table is required for troubleshooting.

**Table 7-3: Equipment required for BG7 Black Generator troubleshooting**

| Equipment description | Minimum requirements/example |
|---|---|
| Screwdriver handle | Accept Phillips-driver bits |
| #1 Phillips tip | Phillips-driver bit for #1 size screw heads |
| TG700 mainframe | A TG700 mainframe that is functioning correctly |

## Backing Up the Instrument Settings

Before you begin the trouble shooting procedures, create a preset to save your instrument settings as follows:

1. Press the **MODULE** button until the mainframe main menu (TG700: PRESET) appears.
2. Press the **ENTER** button to access the PRESET submenu.
3. Press the up (▲) or down (▼) arrow button to select **SAVE**.
4. Press the left (◄) or right (►) arrow button to select a preset number to save instrument settings.
5. Press the **ENTER** button to save the current instrument settings to the new preset.

After the problem is solved, recall the preset you created.

## Troubleshooting Trees

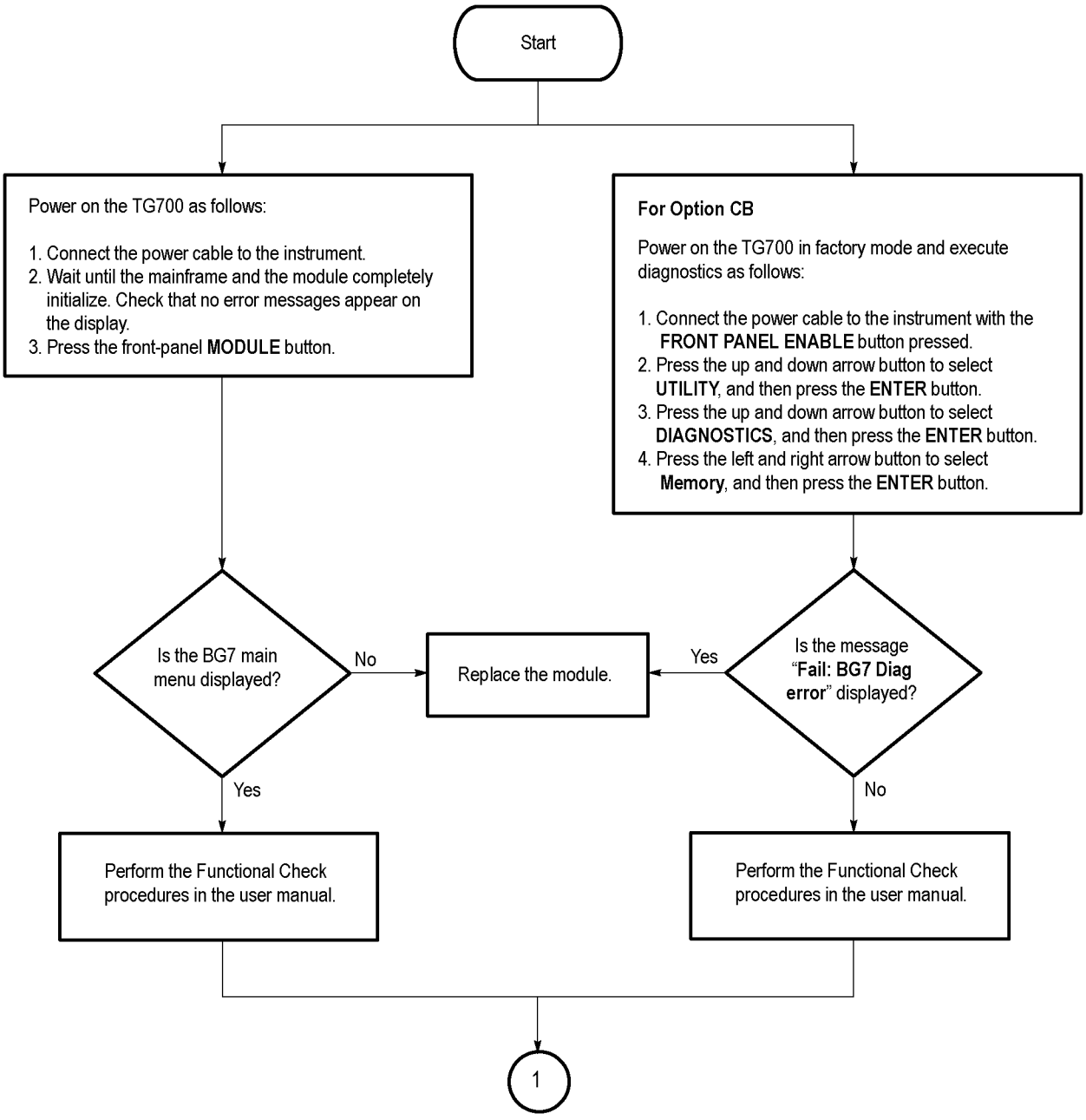

Start
Power on the TG700 as follows:
1. Connect the power cable to the instrument.
2. Wait until the mainframe and the module completely initialize. Check that no error messages appear on the display.
3. Press the front-panel MODULE button.
For Option CB
Power on the TG700 in factory mode and execute diagnostics as follows:
1. Connect the power cable to the instrument with the FRONT PANEL ENABLE button pressed.
2. Press the up and down arrow button to select UTILITY, and then press the ENTER button.
3. Press the up and down arrow button to select DIAGNOSTICS, and then press the ENTER button.
4. Press the left and right arrow button to select Memory, and then press the ENTER button.
Is the BG7 main menu displayed?
No
Replace the module.
Yes
Is the message "Fail: BG7 Diag error" displayed?
Yes
No
Perform the Functional Check procedures in the user manual.
Perform the Functional Check procedures in the user manual.
1

**Figure 7-5: Troubleshooting procedure (1)**

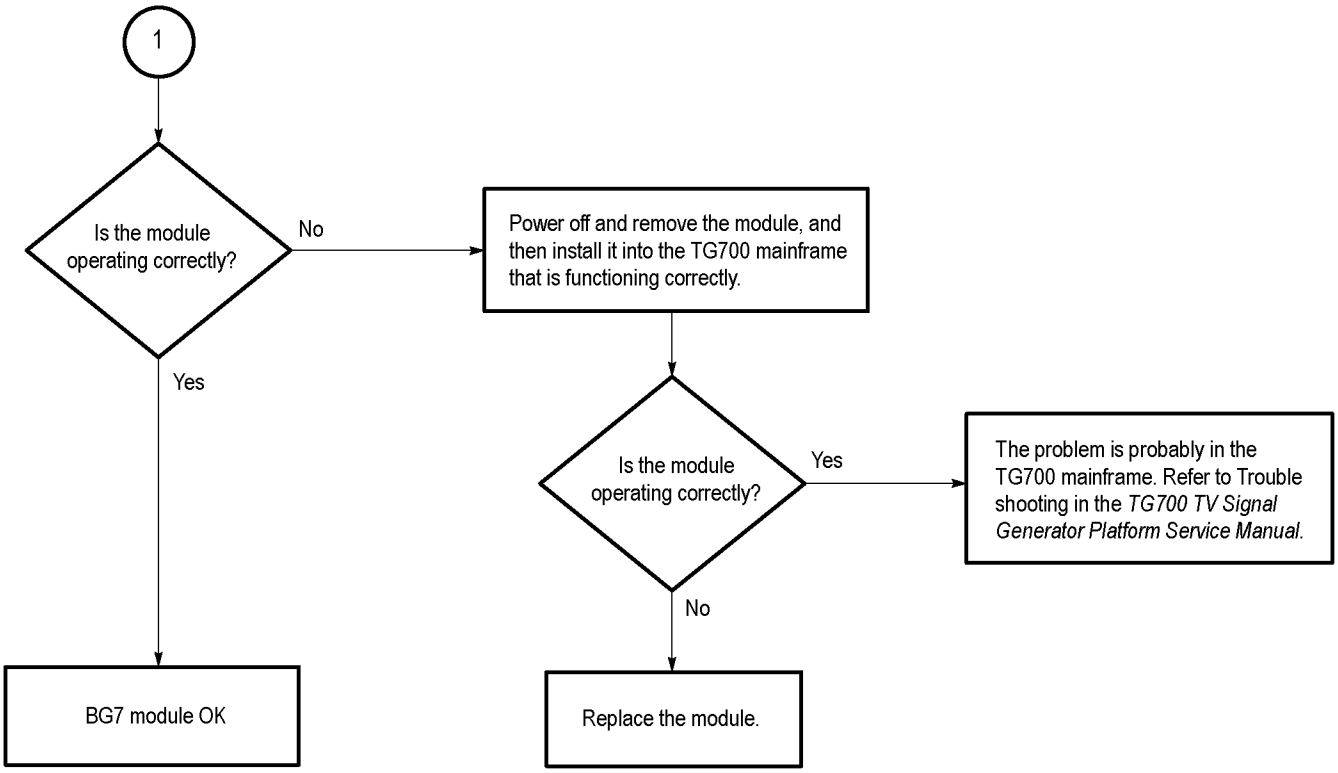

1
Is the module operating correctly?
No
Power off and remove the module, and then install it into the TG700 mainframe that is functioning correctly.
Yes
Is the module operating correctly?
Yes
The problem is probably in the TG700 mainframe. Refer to Trouble shooting in the TG700 TV Signal Generator Platform Service Manual.
No
BG7 module OK
Replace the module.

**Figure 7-6: Troubleshooting procedure (2)**

# BG7 Black Generator Diagram

The following figure shows the BG7 Generator module and how it interconnects with the TG700 TV Signal Generator Platform. Diagrams showing mainframe component interconnections, such as power supply and oscillator, can be found in the *TG700 Diagram* section of this manual. (See page 1-28, *TG700 Mainframe Diagrams*.)

A block diagram of the BG7 Generator module is located in the *Theory of Operation* section. (See page 7-1, *BG7 Black Generator Theory of Operation*.)

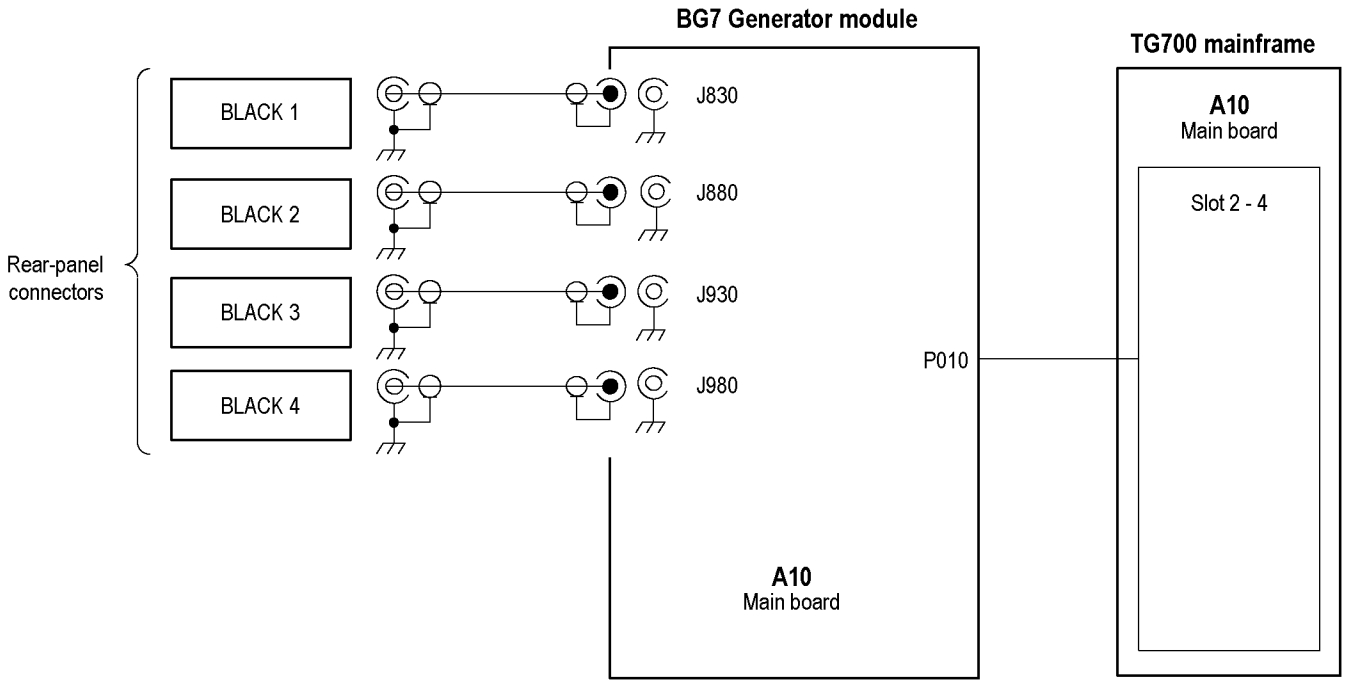



**Figure 7-7: BG7 Generator module connections**

# BG7 Black Generator Replaceable Parts List

This section contains a list of the replaceable modules for the BG7 Generator module. Use this list to identify and order replacement parts. For parts ordering or servicing information, see *Parts Ordering Information* or *Module Servicing* in the *TG700 Mainframe Replaceable Parts List* section of this manual. (See page 1-31, *TG700 Mainframe Replaceable Parts List*.)

## Abbreviations

Abbreviations conform to American National Standard ANSI Y1.1-1972.

### Table 7-4: BG7 Black Generator – replaceable parts

| Fig. & index number | Tektronix part number | Serial no. effective | Serial no. discont'd | Qty | Name & description |
|---|---|---|---|---|---|
| 7-8- | 116-A003-01 | | | 1 | EXCHANGE MODULE:BG7 |
| | 116-A004-01 | | | 1 | EXCHANGE MODULE:BG7-CB |
| 7-8-1 | 441-A269-02 | | | 1 | CHASSIS,MODULE AGL7:ASSY |
| -2 | 333-A406-00 | | | 1 | PANEL,REAR:BG7,AL |
| -3 | 214-4946-00 | | | 2 | SPRING,CONICAL:VXI MOUNTING SCREW,0.26 MM SUS304,5.4 MML |
| -4 | 213-1129-01 | | | 2 | SCREW,MACHINE:M2.5X11MM L,PAN HD,STL,N1 PL,CROSS REC & SLOTTED |
| -5 | 348-A128-00 | | | 2.5 CM | SHLD GASKET,ELEK:FINGER TYPE,5.1MM LX6.4MM W,BE-CU [97-645-02] |
| -6 | 174-B851-00 | | | 4 | CABLE ASSY,RF:75OHM COAX(RG179),5.5CM L,BNC TO MCX |
| -7 | 211-A245-01 | | | 5 | SCREW,MACHINE:M3X6MM L,PNH,STL,NI PL,CROSS REC,W/KOGATAMARU&LOCK WASHER |
| -8 | 334-1378-03 | | | 1 | MARKER,IDENT:MKD SERIAL NO. |
| | | | **STANDARD ACCESSORIES** | | |
| | 075-0986-XX | | | 1 | MANUAL,TECH:MODULE INSTALLATION INSTRUCTIONS |
| | 063-3939-XX | | | 1 | KIT: SOFTWARE LIBRARY, DOCUMENTATION DVD |
| | | | **OPTIONAL ACCESSORIES** | | |
| | 003-A041-00 | | | 1 | NUTDRIVER,BOX:14MM HEX,BNC RETAINING NUT, MODIFIED 19MM |

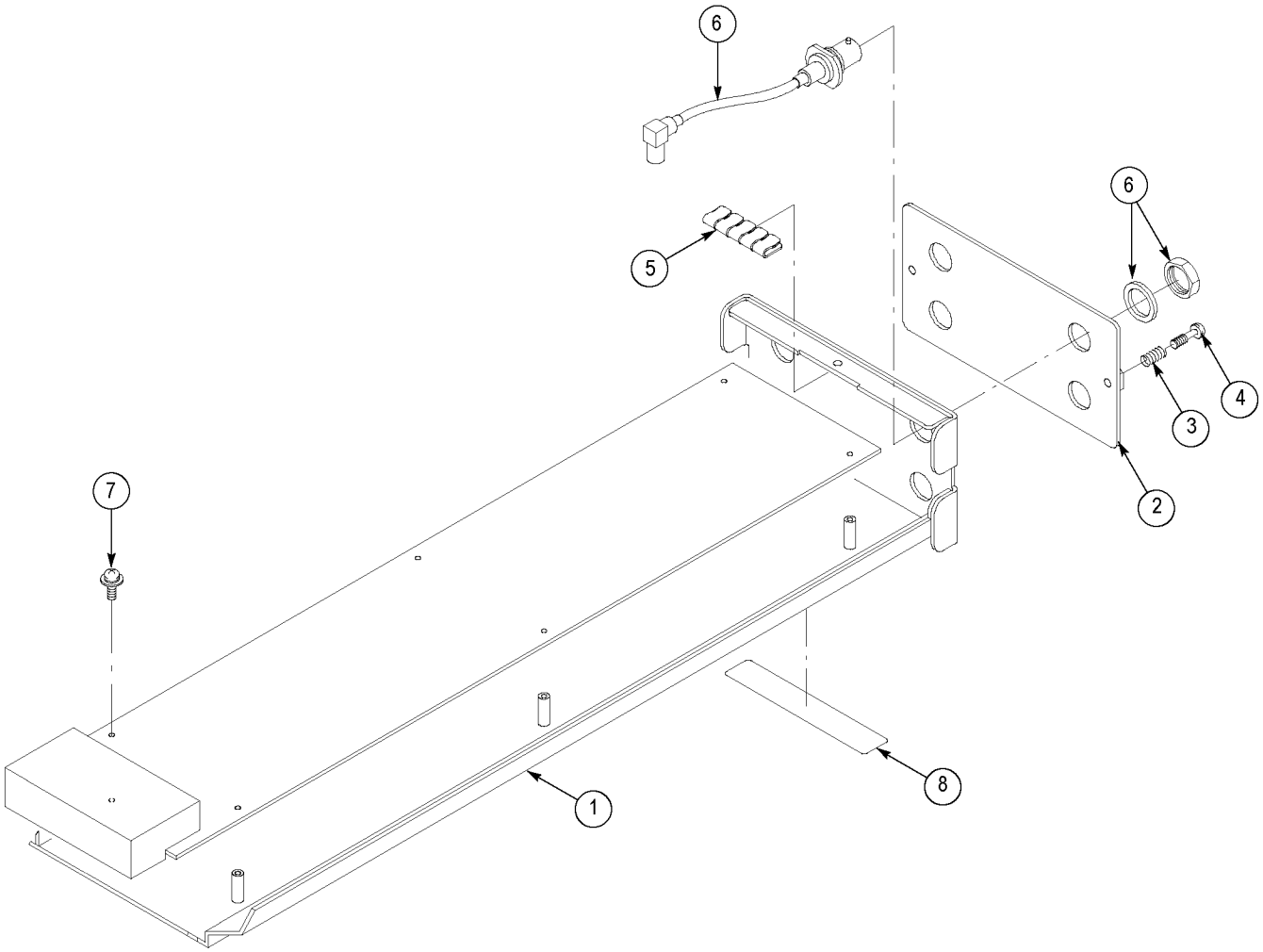



**Figure 7-8: BG7 Generator module exploded view**

# DVG7 Digital Video Generator

# DVG7 Digital Video Generator Theory of Operation

This section describes the basic operation of the major circuit blocks in the DVG7 Generator module.

**Bus Interface** This block provides the communication between the mainframe and the module circuit.

**Address Generator** This block consists of a frame delay, an MPU interface, a sequencer, an SDRAM controller, and a blanking data generator. It interfaces the Frame Memory and the Line Memory and controls the output sequence of the video data in these memories.

**Frame Memory** The frame memory contains a series of pointers that control the order the video lines stored in Line Memory are used to produce the serial digital signals.

**Line Memory** The memory holds the actual sample points that define a serial digital signal.

**Overlay Controller** This block consists of an MPU interface and an overlay controller. It inserts data from the Overlay Memory into the Line Memory data stream to create circular patterns, ID text, and logo.

**Overlay Memory** The memory generates timings to multiplex the line memory data and the overlay data used for a circle, ID text, and logo overlay.

**Formatter** This block consists of an audio control packet generator, a data packet generator, an MPU interface, and an SRAM controller. The formatter inserts embedded audio data in serial digital signals.

**Audio Memory** The memory contains embedded audio data.

**Serializer** This block converts a 10 bits parallel data to SDI signal.

**Black Generator (Option BK Only)** This block generates black or gray (40% gray) signal for the BLACK 1 and BLACK 2 outputs.

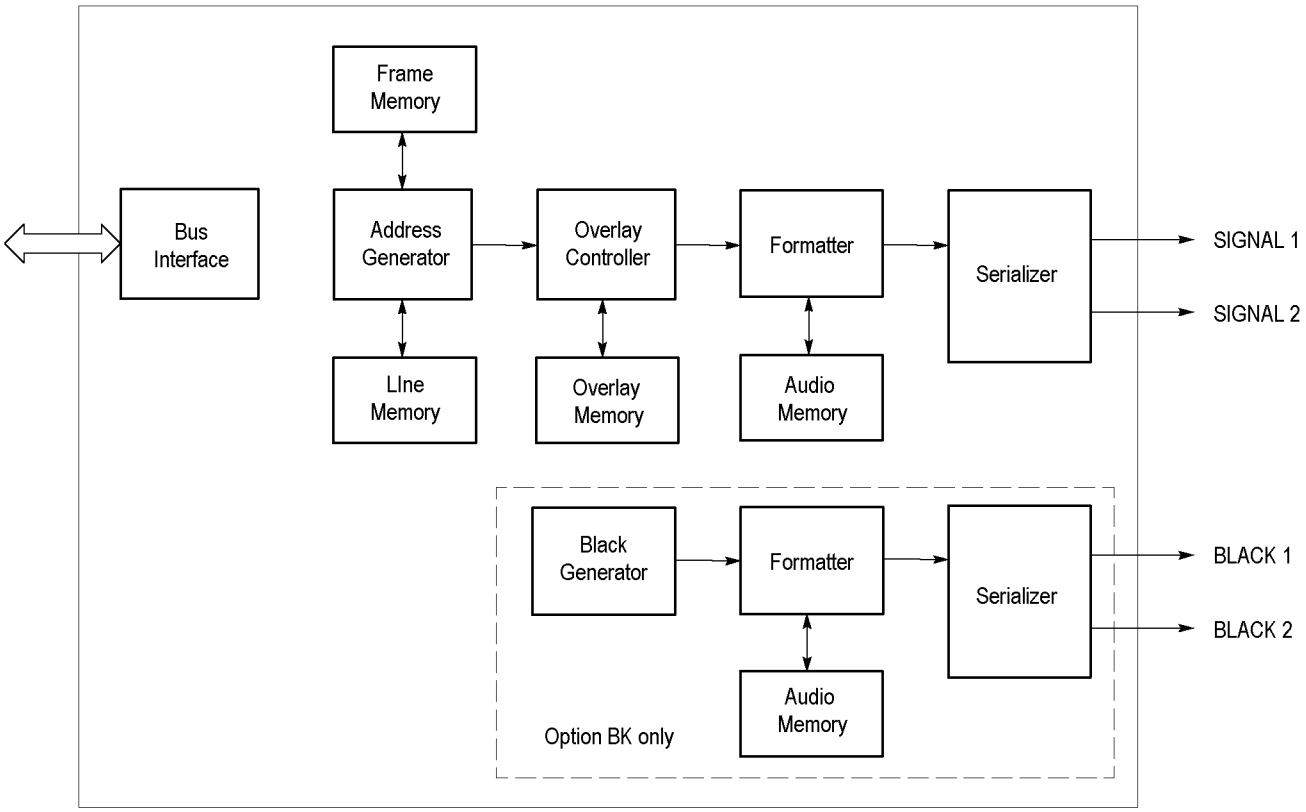



**Figure 8-1: Simplified block diagram of the DVG7 Generator module**

# DVG7 Digital Video Generator Adjustment Procedures

The only adjustment in the DVG7 Generator module is for the output level.

## Requirements for Adjustment

Before doing the adjustment, note the following requirements.

### Personnel

This procedure is only to be performed by trained service technicians.

### Warm-Up Period

The DVG7 Generator module requires a 20 minute warm-up time in a +20 °C to +30 °C environment before it is adjusted. Adjustments done before the operating temperature has stabilized may cause errors in performance.

### Access

When adjusting the output level, you need to remove the top cover of the TG700 mainframe. (See page 1-15, *Top Cover*.)

## Equipment Required

The following table lists the equipment required to adjust the output level.

**Table 8-1: Equipment required for DVG7 Digital Video Generator adjustment procedures**

| Item | No. | Minimum requirement | Recommended equipment |
|---|---|---|---|
| TV signal generator platform | 1 | | Tektronix TG700 |
| Oscilloscope | 1 | Bandwidth: 1 GHz or higher | Tektronix TDS784D |
| 75 Ω BNC cable | 1 | Length: 42 inches | Tektronix part number 012-0074-00 |
| 75 Ω coaxial terminator | 1 | | Tektronix part number 011-0102-01 |
| 75 Ω signal adapter | 1 | Bandwidth: 1 GHz<br>Amplitude precision: –3 dB | Tektronix AMT75 |

## Output Level Adjustment

### Preparation

To perform the output level adjustment, you must first remove the top cover of the TG700 mainframe. (See page 1-15, *Top Cover*.)

After you have removed the top cover, find the variable resistors on the DVG7 circuit board. (See Figure 8-2.)

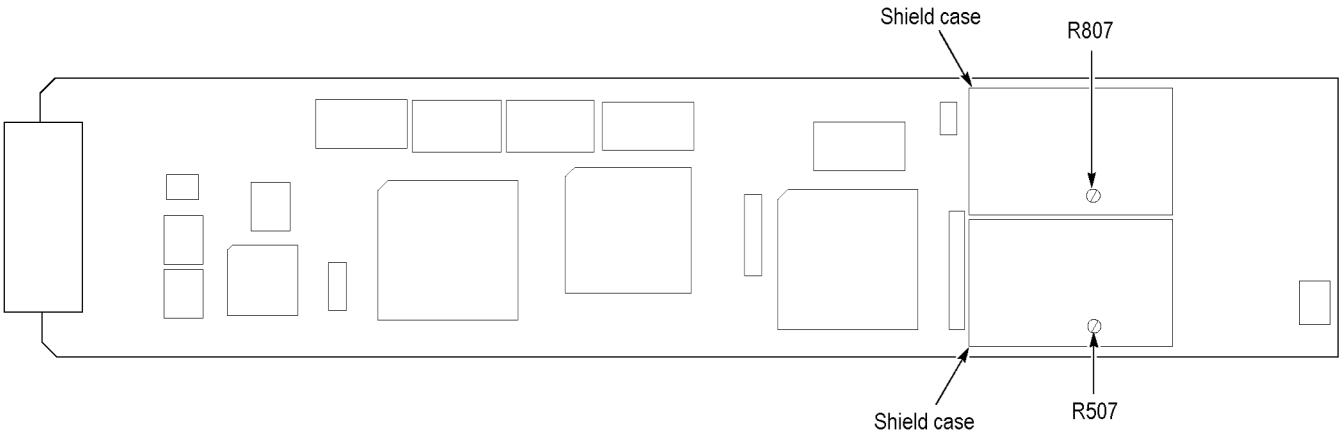



**Figure 8-2: DVG7 circuit board view**

## Procedure

***WARNING.*** *To avoid serious injury, do not touch exposed connectors or components when operating the TG700 mainframe with the top cover removed. Dangerous potentials exist at several points within the TG700 mainframe.*

1. Use the 75 Ω BNC cable and 75 Ω signal adapter to connect the SIGNAL 1 connector on the DVG7 Generator module to the CH1 input connector on the oscilloscope. (See Figure 8-3.)

***NOTE.*** *Some sampling oscilloscopes do not automatically adjust their readouts to account for the ÷5 attenuation of the AMT75. You must remember to account for this attenuation while viewing the oscilloscope readouts if you are using an oscilloscope of this type.*

2. Use the 75 Ω coaxial terminator to terminate the SIGNAL 2 connector on the DVG7 Generator module.

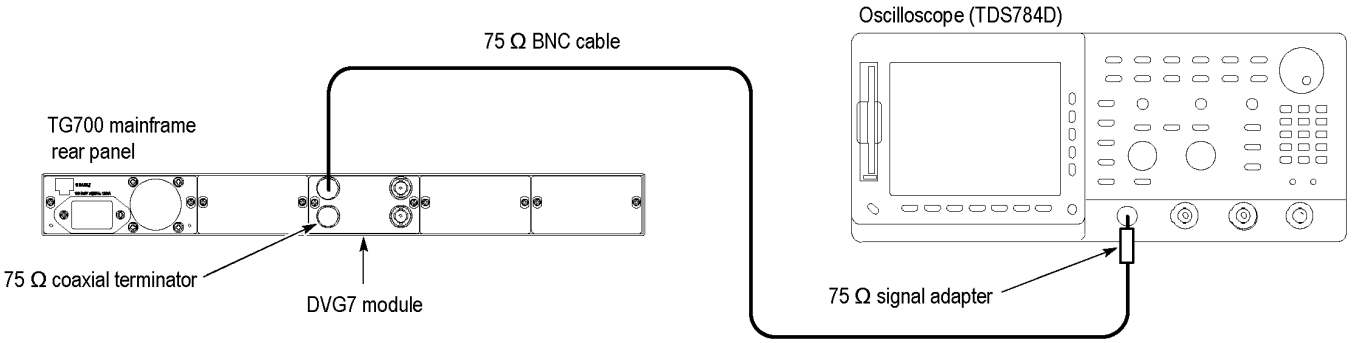



**Figure 8-3: Equipment connection for adjusting the output level**

3. Set the oscilloscope settings as indicated below:

| | |
|---|---|
| Vertical | 160 mV/div |
| Horizontal | 1 ns/div |
| Record Length | 500 points in 10 div |
| Trig Position | CH4 |
| Trig Source | 50% |
| Trig Slope | Rising Edge |
| Acquire Menu | Sample |
| DPO (InstaVu) | Infinite Persistence |

1. Recall the Factory Default preset as follows:
   a. Press the up (▲) or down (▼) arrow button to select **RECALL**.
   b. Press the left (◄) or right (►) arrow button to select **Factory Default**.
   c. Press the **ENTER** button to recall the factory default settings.
   d. Press the **CANCEL** button to return the TG700 main menu.
2. Select the **75 % Color Bars** signal as follows:
   a. Press the MODULE button to display the **DVG7** main menu.
   b. Press the **COLOR BAR** test signal button until the **75 % Color Bars** signal is selected.
3. Turn on the "Cursor: HBars" of the sampling oscilloscope, and then set the nV to 800 mV.
4. Change the cursor mode to Track, and then position the cursors so that they are symmetrical about the center graticule.
5. Locate variable resistor R507 on the DVG7 circuit board. (See Figure 8-2.)
6. Adjust R507 so that the signal amplitude is equal to the height between the two cursors set in step 6.

**BLACK output level adjustment (Option BK only).**

7. Move the BNC cable from the SIGNAL 1 connector to the BLACK 1 connector and move the 75 Ω terminator from the SIGNAL 2 connector to the BLACK 2 connector on the DVG7 Generator module.
8. Select the **40 % Flat Field** signal as follows:
   a. Press the **CANCEL** button to return the module main menu.
   b. Press the up (▲) or down (▼) arrow button to select **BLACK (OPTION)**.
   c. Press the **ENTER** button to access the BLACK submenu.
   d. Press the up (▲) or down (▼) arrow button to select **SIGNAL**.
   e. Press the left (◄) or right (►) arrow button to select **40 % Flat Field** and press the **ENTER** button.
9. Locate variable resistor R807 on the DVG7 circuit board. (See Figure 8-2.)
10. Adjust R807 so that the signal amplitude is equal to the height between two cursors set in step 6.

This completes the output level adjustment procedures.

# DVG7 Digital Video Generator Maintenance

This section contains instructions and procedures for maintaining the DVG7 Generator module. Before following these procedures, read *Maintenance for Generators and Modules*. (See page xix.)

The following information can be found in this section:

- Removal and Replacement (See page 8-8.)
- Troubleshooting (See page 8-10.)

If the instrument does not function properly, troubleshooting and corrective measures should be taken immediately to prevent additional problems.

***NOTE.*** *Contact your local Tektronix representative for information on where to return your instrument if it requires repair during the warranty period.*

# DVG7 Digital Video Generator Removal and Replacement

This section contains the instructions on how you can remove and replace the customer replaceable parts of the DVG7 Generator module.

## Tools Required

The following tools are required to perform the removal and replacement procedures:

**Table 8-2: Required tools for removal and replacement of DVG7 Digital Video Generator**

| Name | Description | Tektronix part number |
|---|---|---|
| Screwdriver handle | Accepts Phillips-driver bits | |
| #1 Phillips tip | Phillips-driver bit for #1 size screw heads | |
| #2 Phillips tip | Phillips-driver bit for #2 size screw heads | |
| Nut driver, 14 mm | Special nut driver for removing the BNC connectors of the DVG7 module | 003-A041-00 |

## Replacing the Rear-Panel Connectors and Chassis

It is usually not necessary to replace the rear-panel connectors or chassis. However, if a connector or chassis becomes damaged, you can replace it.

### Replacing the Rear-Panel Connectors

Perform the following procedure to replace the rear-panel connector:

1. Use the *Removing a Module* section to remove the DVG7 Generator module from the mainframe. (See page 1-41, *Removing a Module*.)
2. Disconnect the cables at P500 (SIGNAL 1) and P502 (SIGNAL 2) on the DVG7 circuit board. If Option BK is installed, also disconnect the cables at J800 (BLACK 1) and J802 (BLACK 2).
3. Use the 14 mm nut driver to remove the nut securing the damaged connector to the chassis. Pull the connector away.
4. Perform steps 2 and 3 in reverse order to replace the connector.

## Replacing the Chassis

Perform the following procedure to replace the chassis:

1. Use the 14 mm nut driver to remove the nuts from each of the rear-panel connectors.
2. Use a screwdriver with a #2 Phillips tip to remove the six screws securing the DVG7 circuit board to the chassis.
3. Lift the circuit board up and away from chassis, and then place it on a static free surface.
4. If Option BK is installed, skip this step:
   a. Use a screwdriver with a #2 Phillips tip to remove the two screws securing the rear panel to the chassis.
5. Set the replacement chassis on a firm, flat, static-free work surface.
6. If Option BK is installed, skip this step:
   a. Use a screwdriver with a #2 Phillips tip to install the two screws securing the rear panel to the chassis.
7. Use a screwdriver with a #2 Phillips tip to install the six screws securing the circuit board to the chassis.

# DVG7 Digital Video Generator Troubleshooting

This section contains instructions and procedures for troubleshooting the DVG7 Generator module. These procedures will help you decide whether it is necessary to replace your module.

If the TG700 mainframe does not boot up or if the display is not working, refer to the *TG700 Mainframe Troubleshooting* section in this manual. (See page 1-24, *TG700 Mainframe Troubleshooting*.)

## Equipment Required

The equipment listed in the following table is required for troubleshooting.

**Table 8-3: Equipment required for DVG7 Digital Video Generator troubleshooting**

| Equipment description | Minimum requirements/example |
|---|---|
| Screwdriver handle | Accept Phillips-driver bits |
| #1 Phillips tip | Phillips-driver bit for #1 size screw heads |
| TG700 mainframe | A TG700 mainframe that is functioning correctly |

## Backing Up the Instrument Settings

Before you begin the troubleshooting procedures, create a preset to save your instrument settings as follows:

1. Press the **MODULE** button until the mainframe main menu (TG700: PRESET) appears.
2. Press the **ENTER** button to access the PRESET submenu.
3. Press the up (▲) or down (▼) arrow button to select **SAVE**.
4. Press the left (◄) or right (►) arrow button to select a preset number to save instrument settings.
5. Press the **ENTER** button to save the current instrument settings to the new preset.

After the problem is solved, recall the preset you created.

## Troubleshooting Trees

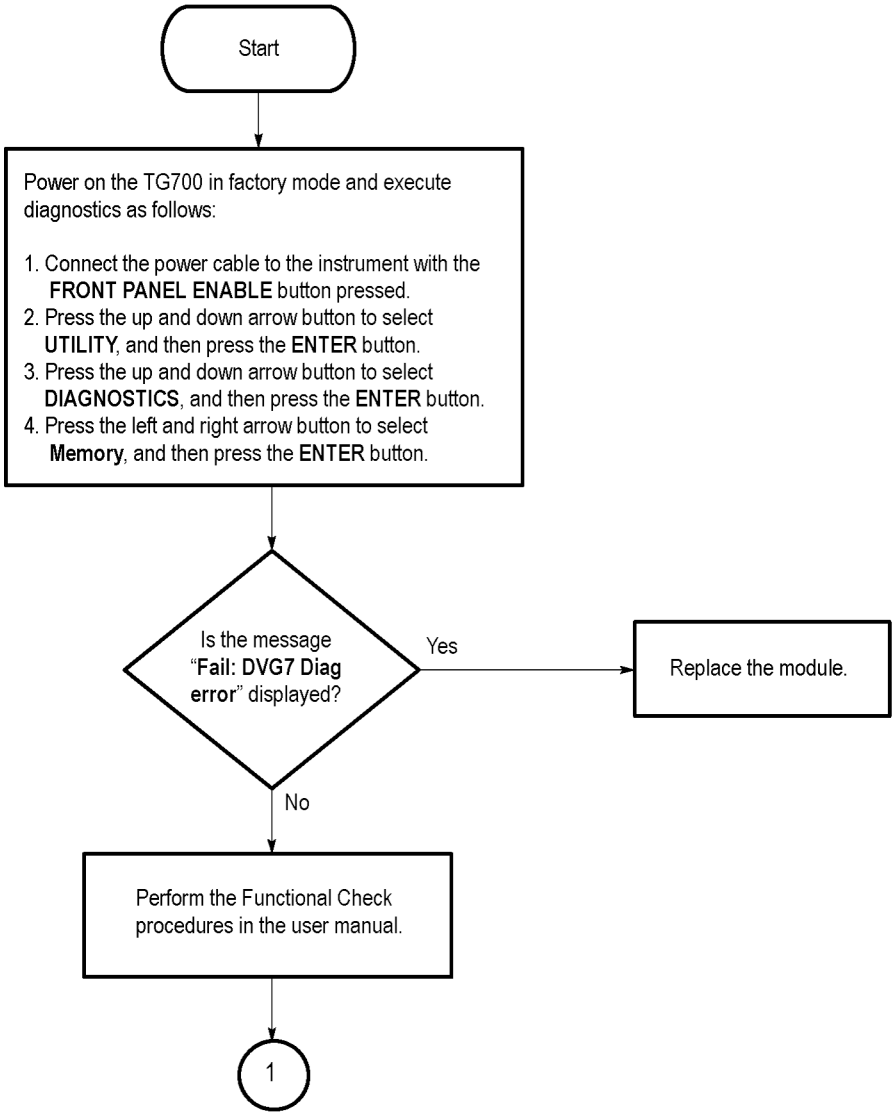

Start
Power on the TG700 in factory mode and execute diagnostics as follows:
1. Connect the power cable to the instrument with the FRONT PANEL ENABLE button pressed.
2. Press the up and down arrow button to select UTILITY, and then press the ENTER button.
3. Press the up and down arrow button to select DIAGNOSTICS, and then press the ENTER button.
4. Press the left and right arrow button to select Memory, and then press the ENTER button.
Is the message "Fail: DVG7 Diag error" displayed?
Yes
Replace the module.
No
Perform the Functional Check procedures in the user manual.
1

**Figure 8-4: Troubleshooting procedure (1)**

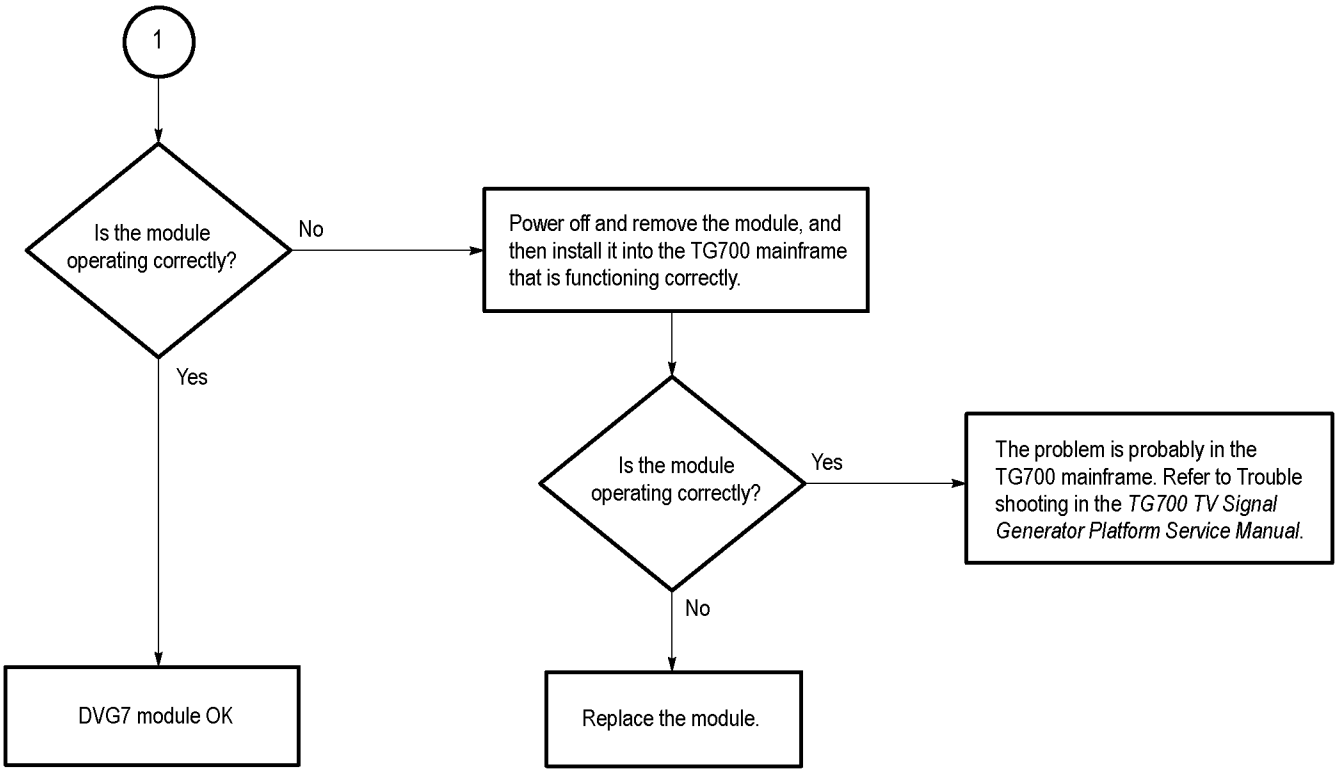

1
Is the module operating correctly?
No
Power off and remove the module, and then install it into the TG700 mainframe that is functioning correctly.
Yes
Is the module operating correctly?
Yes
The problem is probably in the TG700 mainframe. Refer to Trouble shooting in the TG700 TV Signal Generator Platform Service Manual.
No
DVG7 module OK
Replace the module.

**Figure 8-5: Troubleshooting procedure (2)**

# DVG7 Digital Video Generator Diagram

The following figure shows the DVG7 Generator module and how it interconnects with the TG700 TV Signal Generator Platform.

Diagrams showing mainframe component interconnections, such as power supply and oscillator, can be found in the *TG700 Diagram* section of this manual. (See page 1-28, *TG700 Mainframe Diagrams*.)

A block diagram of the DVG7 Generator module is located in the *DVG7 Theory of Operation* section. (See page 8-1.)

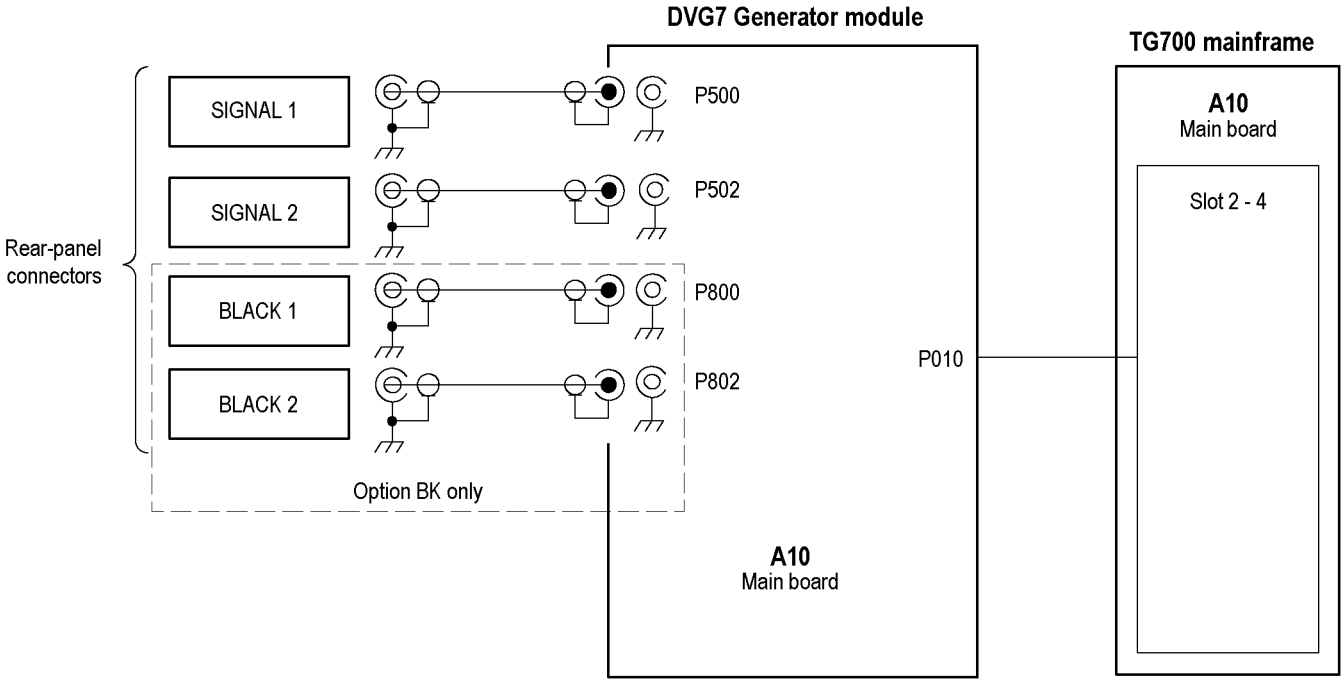



**Figure 8-6: DVG7 Generator module connections**

# DVG7 Digital Video Generator Replaceable Parts List

This section contains a list of the replaceable modules for the DVG7 Generator module. Use this list to identify and order replacement parts. For parts ordering or servicing information, see *Parts Ordering Information* or *Module Servicing* in the *TG700 Mainframe Replaceable Parts List* section of this manual. (See page 1-31, *TG700 Mainframe Replaceable Parts List*.)

## Abbreviations

Abbreviations conform to American National Standard ANSI Y1.1-1972.

### Table 8-4: DVG7 digital video generator –

| Fig. & index number | Tektronix part number | Serial no. effective | Serial no. discont'd | Qty | Name & description |
|---|---|---|---|---|---|
| 8-7- | 116-A005-04 | | | 1 | EXCHANGE MODULE:DVG7 |
| | 116-A006-04 | | | 1 | EXCHANGE MODULE:DVG7-BK |
| 8-7-1 | 441-A273-03 | | | 1 | CHASSIS,MODULE DVG7:ASSY |
| -2 | 333-A407-00 | | | 1 | PANEL,REAR:DVG7,AL |
| | 333-A408-00 | | | 1 | PANEL,REAR:DVG7 OPTION,AL |
| -3 | 214-4946-00 | | | 2 | SPRING,CONICAL:VXI MOUNTING SCREW,0.26MM |
| -4 | 213-1129-01 | | | 2 | SCREW,MACHINE:M2.5X11MM L,PAN HD,STL,NI PL,CROSS REC & SLOTTED |
| -5 | 348-A128-00 | | | 2.5 CM | SHLD GASKET,ELEK:FINGER TYPE,5.1MM LX6.4MM W,BE-CU [97-645-02] |
| -6 | 174-B846-00 | | | 2 | CABLE ASSY,RF:75OHM,COAX(RG179),6CM L,BNC TO PL71-LP-1.5C |
| | 174-B846-00 | | | 4 | CABLE ASSY,RF:75OHM,COAX(RG179),6CM L,BNC TO PL71-LP-1.5C (OPTION BK) |
| -7 | 211-A245-01 | | | 8 | SCREW,MACHINE:M3X6MM L,PNH,STL,NI PL,CROSS REC,W/KOGATAMARU & LOCK WASHER |
| | 211-A245-01 | | | 6 | SCREW,MACHINE:M3X6MM L,PNH,STL,NI PL,CROSS REC,W/KOGATAMARU & LOCK WASHER (OPTION BK) |
| -8 | 334-1378-03 | | | 1 | MARKER,IDENT:MKD SERIAL NO. |
| | | | **STANDARD ACCESSORIES** | | |
| | 075-0986-XX | | | 1 | MANUAL,TECH:MODULE INSTALLATION INSTRUCTIONS |
| | 063-3939-XX | | | 1 | KIT: SOFTWARE LIBRARY, DOCUMENTATION DVD |
| | | | **OPTIONAL ACCESSORIES** | | |
| | 003-A041-00 | | | 1 | NUT DRIVER,BOX:14MM HEX,BNC RETAINING NUT, MODIFIED 19MM |

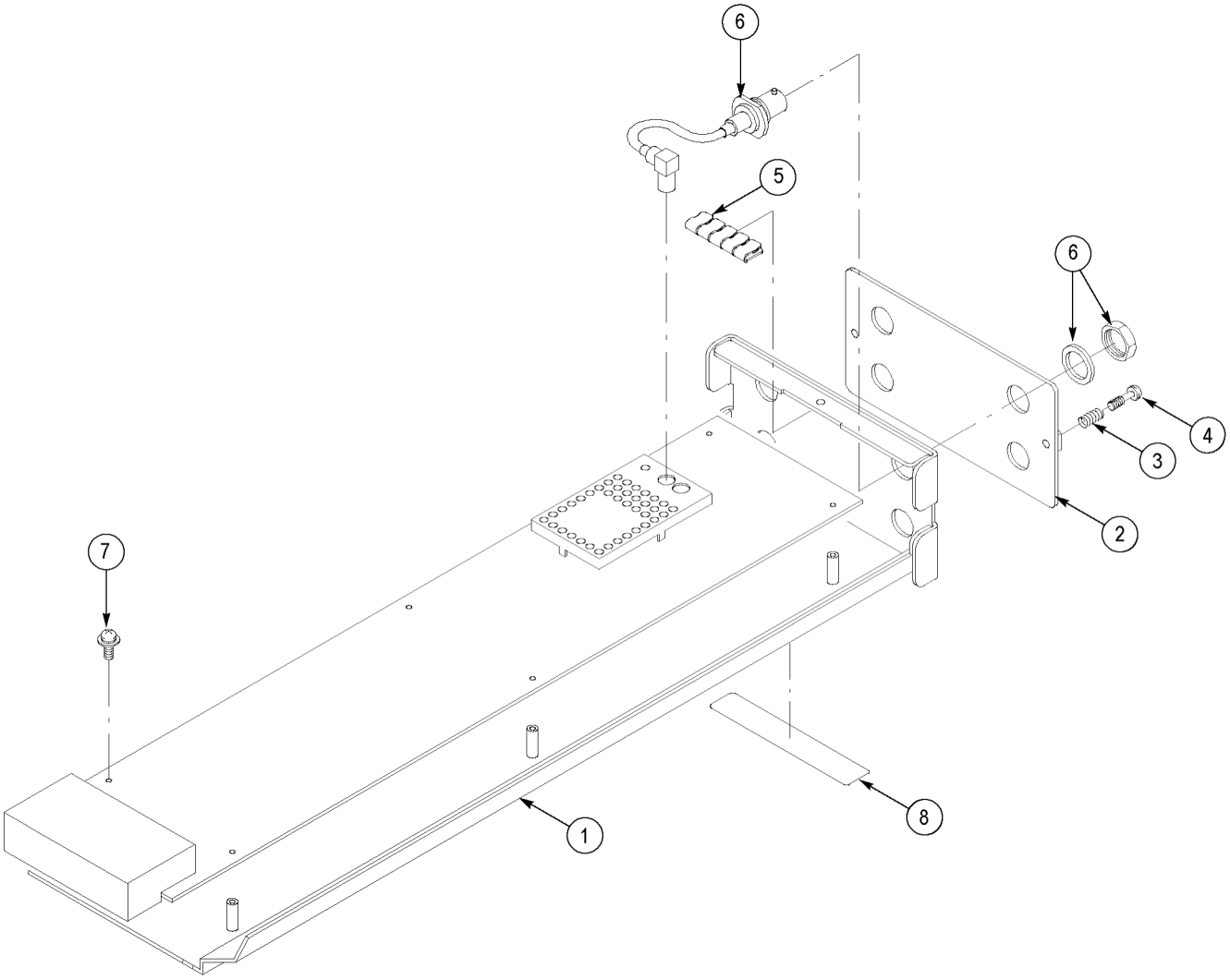



**Figure 8-7: DVG7 Generator module exploded view**

# GPS7 GPS and Genlock Module with Timecode

# GPS7 Theory of Operation

The GPS7 module is a GPS and genlock synchronization module with a timecode reader and generator. This section describes the basic operation of the major circuit blocks in the GPS7 module. (See Figure 9-1.)

All access to the GPS7 module occurs through the address and data busses, shown as the CPU I/O bus. The interface is a PLD on the GPS7 module, which is the central control interface for MCU data transactions to and from the GPS7 module.

## Antenna Connector

The GPS7 module requires an external antenna to receive the GPS time signals from up to 12 satellites. The antenna connector applies these signals to the GPS Receiver board.

## GPS Receiver Loop

The GPS Receiver board block is a Trimble Resolution-T module, which can track up to 12 satellites, and extract and average the time information from them.

The GPS receiver produces a pulse at the rate of 1 pulse per second (PPS) which is compared to a locally generated pulse per second (Local 1 PPS) in the Phase Detector block. The output from the Phase Detector contains a Quantization Error due to the time sampling method used in the GPS receiver board. The GPS receiver also produces a serial data stream detailing the error (which can be up to 20 ns) that is arithmetically removed from the phase detector output (the Quantize Correction path). This corrected phase detector output can be seen on the module diagnostic display.

The corrected phase is first filtered in the averaging and loop control block, and then read by software. The software then writes this to a DAC on the TG700 mainframe board to control the frequency of the mainframe master oscillator (OCXO). This frequency control value can also be seen on the module diagnostic display. The mainframe OCXO oscillator clocks the GPS7 Master Time of Day (MTOD) counter. This completes the loop, spread over the two boards, locking the mainframe oven and MTOD counter to the incoming GPS.

The TG700 OCXO and related circuits produce the 54 MHz and 74 MHz clocks for all modules used in the TG700 Signal Generator System.

## Genlock Control Loop

When in Genlock mode, the Black 1 output is turned off and the BNC is used as an input. The input reference video is buffered then drives a sync separator and an Analog to Digital Converter (ADC). The sync signals allow the Genlock logic to roughly align the internal sync to the incoming video. The sync signal also allows the genlock logic to window on the ADC samples from the sync edge or the burst. The samples are read by the SW which then "closes the loop" by writing to the DAC that controls the OCXO. This sets the phase and frequency of all the internal clocks.

The Genlock Control Loop is only available on GPS7 modules with the REF IN connector on the rear panel.

### MTOD Clock

The Master Time of Day (MTOD) clock contains the precise current time, which is phase locked to the selected time source. The MTOD is used for all time code generation and positioning of the frame reset pulses.

### Outputs

The three Black Generation Engines and the four LTC engines each receive one of three frame reset pulses from the TG700 mainframe, which lock the video frames in all engines to exact references based on MTOD.

In order for many units to have the same phase when locked to GPS, the instrument times the frame pulses to an "Epoch." This means they are timed as though they all started on the time indicated by TAI and the proposed SMPTE time of GMT midnight (00:00:00) on January 1st 1958. The video sequences generated by the GPS7 are set to the correct time by calculating the total time from the SMPTE epoch to the present, and adjusting the frame reset pulses accordingly. The frame reset pulses are used to reset the video generation outputs start position in time.

The GPS7 has 1 GPI (General Purpose Interface) input and 2 GPI outputs that can be set up for event triggering or detection as configured by the user. These are under SW control via FPGA registers.

### Time Code Reader

The time code reader operates on the same ADC data as the genlock. This data is processed to extract the VITC bits and check for valid CRC and continuity. When valid time code is detected, the SW reads the time values from the reader circuits.

The Time Code Reader is only available on GPS7 modules with the REF IN connector on the rear panel.

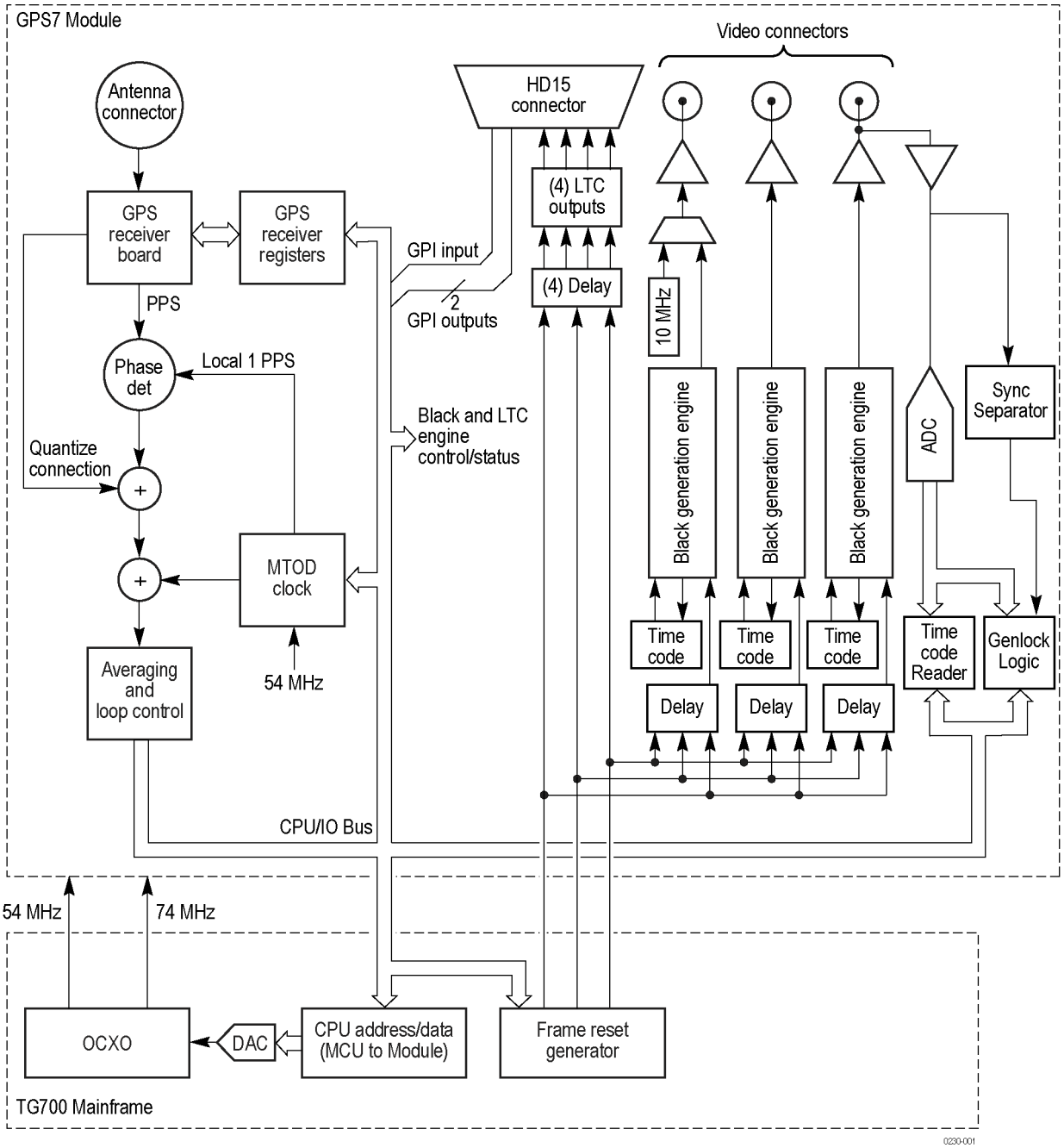



**Figure 9-1: Simplified block diagram of the GPS7 module**

***NOTE.*** *The timecode reader and genlock circuitry is only available on GPS7 modules with the REF IN connector on the rear panel.*

# GPS7 Adjustment Procedures

The GPS7 module has several adjustments associated with it, both to the module (Black Burst Amplitude and Black Burst Offset) and to the mainframe oscillator.

## Requirements for Adjustment

Before doing the adjustment, note the following requirements.

### Personnel

This procedure is only to be performed by trained service technicians.

### Warm-Up Period

The GPS7 Generator module requires a 20 minute warm-up time in a +20 °C to +30 °C environment before it is adjusted. An external antenna or GPS signal must be connected during the warm-up time. Adjustments done before the operating temperature has stabilized may cause errors in performance.

## Equipment Required

The following table lists the equipment required to perform the adjustments needed for this module.

**Table 9-1: Equipment required for GPS7 module adjustment procedures**

| Item | No. | Minimum requirement | Recommended equipment |
|---|---|---|---|
| TV signal generator platform | 1 | | Tektronix TG700 |
| Digital multimeter | 1 | 5 1/2 digits | FLUKE 8842A |
| 75 Ω BNC cable | 1 | Length: 42 inches | Tektronix part number 012-0074-00 |
| 75 Ω coaxial precision terminator | 1 | 75 Ω ±0.1% | Tektronix part number 011-0102-03 |
| BNC T connector | 1 | | Tektronix part number 103-0030-00 |
| BNC female to dual banana adapter | 1 | | Tektronix part number 103-0090-00 |
| GPS antenna feed with good signal level | 1 | Less than 5 dB attenuation since last amplifier | Trimble Bullet III, 5v, 35 dB gain, antenna with F-connector, or equivalent.<br>Cable (use only if you do not have a GPS feed): up to 200 ft Belden 1694A, or equivalent, with an F connector on one end and a BNC connector on the other end. |

## GPS7 Black Burst Adjustments

**Black burst level and offset adjustments.** Perform the following procedure to adjust the GPS7 Black Burst Level and Black Burst Offset.

1. Press the **MODULE**, **FORMAT**, and **FRONT PANEL ENABLE** buttons simultaneously, then release the **MODULE** and **FORMAT** buttons. Continue to hold the **FRONT PANEL ENABLE** button until you see the **Startup with Factory Mode** message, then release the button.
2. Connect the Black 1 output to the multimeter as shown. (See Figure 9-2.)

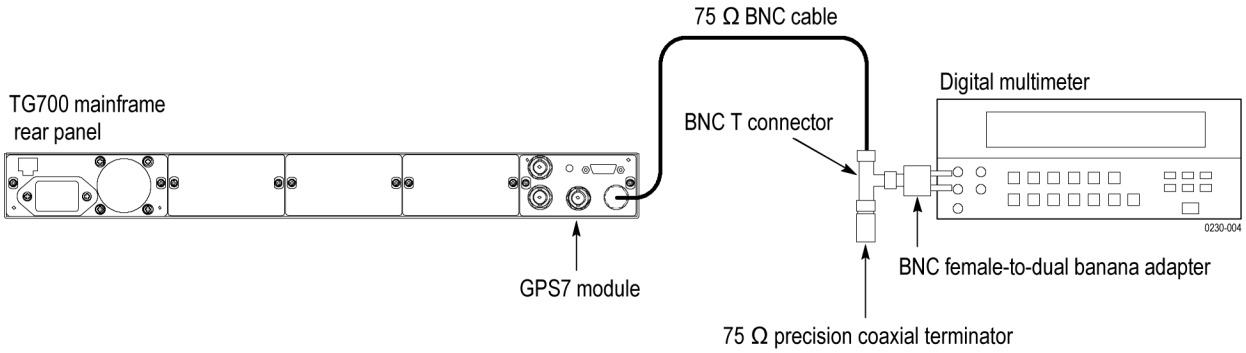



**Figure 9-2: Equipment connections for GPS7 adjustments**

3. Press the **MODULE** button to display the GPS7 main menu.

4. **Set the Black level:**

   **a.** Press the up (▲) or down (▼) arrow button to select **SELECT OUTPUT**.

   **b.** Press the left (◄) or right (►) arrow button to select **BLACK 1**, and then press the **ENTER** button.

   **c.** Press the up (▲) or down (▼) arrow button to select **CALIBRATION**.

   **d.** Press the left (◄) or right (►) arrow button to select **AMPLITUDE CALIBRATION**, and then press the **ENTER** button.

   **e.** Press the left (◄) or right (►) arrow button to select the **0 mV** signal.

   **f.** Make a note of the voltmeter reading.

   **g.** Press the left (◄) or right (►) arrow button to select the **700 mV** signal.

   **h.** Make a note of the voltmeter reading.

   **i.** Subtract the voltage measured in part e. of this step (0 mV setting) from the voltage measured in part g of this step (700 mV setting).

   **j.** If the result is <698 mV or >702 mV, use the up (▲) or down (▼) arrow buttons to adjust the gain.

   **k.** Repeat parts d through i of this step until the difference between the two signals is 700 mV ± 2 mV.

   **l.** Press the **ENTER** button to save the setting and exit the amplitude calibration menu.

5. **Set Black offset:**

   **a.** Proceeding from the previous step, use the left (◄) or right (►) arrow button to select **Offset Calibration**, and then press the **ENTER** button.

   **b.** Use the left (◄) or right (►) arrow button to select the **0 mV** signal.

   **c.** Measure the offset voltage.

   **d.** If necessary, use the up (▲) or down (▼) arrow buttons to adjust the offset voltage to 0 V ±5 mV.

   **e.** Press the **ENTER** button to save the setting and exit the offset calibration menu.

6. Move the cable to the next output and repeat steps 3 through 5 for the BLACK 2 and BLACK 3 outputs.

## Mainframe Oscillator Adjustments

**Internal frequency calibration.** Perform the following procedure to set the internal frequency of the mainframe internal oscillator. This adjustment stores the current frequency of the oscillator while it is locked to a GPS or a reference signal, to be used when in **Internal** mode. It can be done without any disruption to operation and is best done in the operating environment of the instrument.

1. Verify that the instrument has warmed up for a minimum of 20 minutes, with the antenna or GPS signal connected.
2. Press the **MODULE** button until **GPS7 : STATUS** appears.
3. Check that the signal status shows **Locked**.
4. Check that signal lock indicator displays **Fine**:
   a. Press the up (▲) arrow button to select **DIAGNOSTICS**.
   b. Press the **ENTER** button.
   c. Press the right (►) arrow button to select **TUNE**.
   d. Check that **Fine** is showing on the right side of the LCD display.
5. Press the **MODULE** button until **TG700** appears.
6. Press the up (▲) arrow button to select **UTILITY**.
7. Press the **ENTER** button.
8. Press the up (▲) arrow button to select **CAL OVEN : SELECT**.
9. Press the **ENTER** button to access the **Internal Frequency Calibration** submenu.
10. Press the **ENTER** button to execute the calibration. The resulting value should be between 6,000 and 20,000. If the value is outside this range the oven oscillator may need to be replaced.
11. Press the **ENTER** button to return.
12. Press the **CANCEL** button to exit the calibration menu when the calibration is complete.

**Gain calibration.** Perform the following procedure to characterize the oscillator frequency as a function of voltage. This adjustment needs to be performed in factory mode and is only needed once to characterize the oscillator.

***CAUTION.*** *To avoid signal errors, only perform the Gain Calibration when the instrument is out of service. This calibration temporarily disrupts the frequency of all signals in the instrument.*

1. If proceeding from the previous procedure, skip to step 8 of this procedure.
2. Connect a GPS signal to the antenna input on the rear of the module.
3. Press the **MODULE**, **FORMAT**, and **FRONT PANEL ENABLE** buttons simultaneously, then release the **MODULE** and **FORMAT** buttons. Continue to hold the **FRONT PANEL ENABLE** button until you see the **Startup with Factory Mode** message, then release the button.
4. Allow the instrument to warm up for a minimum of 20 minutes.
5. Press the **MODULE** button until **GPS7 : STATUS** appears.
6. Check that the signal status shows **Locked**.
7. Check that signal lock indicator displays **Fine**:
   a. Press the up (▲) arrow button to select **DIAGNOSTICS**.
   b. Press the **ENTER** button.
   c. Press the right (►) arrow button to select **TUNE**.
   d. Check that **Fine** is showing on the right side of the LCD display.
8. Press the **MODULE** button until **TG700** appears.
9. Press the up (▲) arrow button to select **UTILITY**.
10. Press the **ENTER** button.
11. Press the up (▲) arrow button to select **CAL OVEN : SELECT**.
12. Press the right (►) arrow button to access the **Gain Calibration** submenu.
13. Press the **ENTER** button to calculate the gain value.
14. Wait approximately 20 seconds for the process to end.
15. The result is displayed, and should be between 125 and 185. If it is close to the ends of this range, the oscillator may need servicing.
16. Press the **ENTER** button to return.

17. Press the **CANCEL** button to exit the calibration menu when the calibration is complete.

18. Wait an additional 2 minutes for the loop to fully recover before returning the TG700 to service.

# GPS7 Module Maintenance

This section contains instructions and procedures for maintaining the GPS7 module. Before following these procedures, read *Maintenance for Generators and Modules*. (See page xix.)

The following information can be found in this section:

- Removal and Replacement (See page 9-10.)
- Troubleshooting

If the instrument does not function properly, troubleshooting and corrective measures should be taken immediately to prevent additional problems.

***NOTE.*** *Contact your local Tektronix representative for information on where to return your instrument if it requires repair during the warranty period.*

## GPS7 Module Removal and Replacement

This section contains instructions on how to remove and replace the customer parts of the GPS7 module.

### Tools Required

**Table 9-2: Required tools for GPS7 removal and replacement**

| Name | Description | Tektronix part number |
|---|---|---|
| Screwdriver handle | Accepts $^{1}/_{4}$ inch screwdriver bits | Standard tool |
| T10 TORX tip | TORX driver bit for T10 size screw heads | Standard tool |
| Flat or Phillips tip | Small tip for removing the module from the mainframe | Standard tool |
| $^{9}/_{16}$ inch wrench | Wrench or deep nut driver, to remove nuts from BNC connectors | Standard tool |
| $^{3}/_{16}$ inch socket | Socket or nut driver to remove jackscrews from DSUB connector | Standard tool |

### Remove the GPS7 Module

Use the *Removing a Module* section to remove the GPS7 module from the mainframe. (See page 1-41, *Removing a Module*.)

## Replacing the ANTENNA POWER Indicator (Light Pipe)

***CAUTION.*** *Do not remove the light pipe board connector from the board unless you have a replacement board connector available. Removing the light pipe board connector damages it, so it can not be reused.*

1. Pull the light pipe out of its board connector. This is a slip-fit and should come apart easily.
2. Remove the external rear panel:
   a. Use the $^{9}/_{16}$ inch wrench to remove the nuts from the four BNC connectors on the rear panel.
   b. Move the external rear panel away from the chassis, pulling the light pipe out with it.
3. Pull the light pipe out of the light pipe lens in the external rear panel. This is a slip-fit and should come apart easily.
4. Gently remove the light pipe lens from the external rear panel.
5. When reassembling, follow this sequence:
   a. Insert the light pipe into the light pipe lens.
   b. Thread the light pipe through the external rear panel until the lens is against the rear panel.
   c. Gently push the light pipe lens into place in the rear panel.
   d. Replace the external rear panel.
   e. Plug the light pipe into the light pipe board connector.

## Replacing Damaged Connectors

***NOTE.*** *The **Black 1**, **Black 2**, and **Black 3** BNC connectors are not customer replaceable.*

**Antenna connector.** To remove the Antenna connector:

1. Use the $^{9}/_{16}$ inch socket to remove the nut on the **Antenna** BNC connector. When reinstalling, tighten the nut to 14 in/lb.
2. Unplug the RF coaxial cable from P1 on the Trimble GPS Receiver board.
3. Remove the **Antenna** connector, threading the cable through the rear panel.

**LTC/GPI connector.** To remove the LTC/GPI connector:

1. Use the $^{3}/_{16}$ inch hex driver to remove the jackscrews securing the LTC/GPI connector to the rear panel. When reinstalling, use the hex driver to tighten the jackscrews hand tight.
2. Unplug the LTC/GPI cable from J10 on the GPS7 Main board and remove it from the cable clamp.

   When reinstalling, twist the cable twice before plugging it in to J10 on the Main board.
3. Remove the LTC/GP DSUB connector and cable.

## Replacing the Chassis

1. Pull the light pipe out of its board connector. This is a slip-fit and should come apart easily.
2. Remove the external rear panel:
   a. Use the $^{9}/_{16}$ inch wrench to remove the nuts from the four BNC connectors on the rear panel.
   b. Move the external rear panel away from the chassis, pulling the light pipe out with it.
3. Unplug the RF coaxial cable from P1 on the Trimble GPS Receiver board, and remove the Antenna connector and cable.
4. Use the $^{3}/_{16}$ inch hex driver to remove the jackscrews securing the LTC/GPI connector to the rear panel. When reinstalling, use the hex driver to tighten the jackscrews hand tight.
5. Remove the LTC/GPI connector from the rear panel.
6. Remove the four T10 screws that attach the circuit board to the chassis. When reassembling, torque these screws to 8 in/lb.
7. Lift the Main board assembly off of the chassis and set it on a static-free work surface.

# GPS7 Troubleshooting

This section contains instructions and procedures for troubleshooting the GPS7 module. These procedures help you decide whether it is necessary to replace your module.

If the TG700 mainframe does not boot up or if the display is not working, refer to the *TG700 Mainframe Troubleshooting* section in this manual. (See page 1-24, *TG700 Mainframe Troubleshooting*.)

## Required Equipment

The equipment listed here is needed to troubleshoot the GPS7 module.

**Table 9-3: Equipment required for GPS7 module troubleshooting**

| Equipment | Requirement | Suggested equipment |
|---|---|---|
| TG700 mainframe | For the GPS7 module under test | Tektronix TG700 |
| TG700 mainframe with GPS7 installed | Fully functional, operating system, for reference | Tektronix TG700 with GPS7 module |
| Waveform monitor | Used to verify correct GPS phase lock operation. Must be able to lock to a reference and display composite inputs | Tektronix WFM7120 |
| GPS Antenna signal source (2) | Good GPS signal required for both the GPS7 under test and the reference unit. If only one antenna feed is available, a signal splitter may be used | |
| Digital Multimeter | Used to check power supply voltages and fuses | Fluke 87 or equivalent |
| 75 Ω BNC cables (4) | Length: 42 inches, used to connect the instruments | Tektronix part number 012-0074-00 |
| ROHS compliant ESD safe soldering workstation | The GPS7 boards do not contain any user-serviceable parts, but any soldering must be ROHS compliant | |
| Frequency Counter (optional) | Used for an alternate method to check frequency accuracy | Fluke PM6685 or equivalent |

## Problem Identification

If there is a problem, first perform the GPS7 Performance Verification procedure, found in the *TG700 TV Signal Generator Platform Specifications and Performance Verification* manual, available on the Web at www.tektronix.com/manuals. Any problems found with that procedure can be a starting point for troubleshooting.

General problems and actions to follow are shown in the following table. (See Table 9-4.)

### Table 9-4: GPS7 module troubleshooting

| Problem | Actions |
|---|---|
| • Fails Power On Self Test (POST)<br>• GPS7 does not appear in menu | • Verify the GPS7 module is installed in slot 1 of the mainframe.<br>• Run power on test procedure. (See page 9-16, *Power on self test*.)<br>• Check for current software. (See page 9-16, *Check installed software*.)<br>• Run power supply test. (See page 9-19, *Power supply test*.)<br>• Swap the module with a known good GPS7 module and try again. |
| • GPS7 does not lock<br>• GPS7 does not acquire satellite | • Run power on test procedure. (See page 9-16, *Power on self test*.)<br>• Check DC antenna power voltage. (See page 9-23, *DC antenna output power voltage*.)<br>• Check GPS antenna signal source. (See page 9-17, *Check GPS antenna signal source*.)<br>• Check diagnostics reported values. (See page 9-18, *Check diagnostic reported values*.)<br>• Swap the module with a known good GPS7 module and try again. |
| • Unstable GPS lock (determined by Performance Verification or through normal use) | • Verify 20 minute warm-up, then recheck stability relative to reference unit.<br>• Check GPS antenna signal source. (See page 9-17, *Check GPS antenna signal source*.)<br>• Verify configuration. (See page 9-17, *Verify configuration*.)<br>• Check diagnostics reported values. (See page 9-18, *Check diagnostic reported values*.)<br>• Run Internal Mode Oven test. (See page 9-24, *Internal mode oven test*.)<br>• If both units have not acquired position, run Acquire New Position procedure. |
| • Frame phase wrong (determined by Performance Verification<br>• Time of Day wrong | • Verify configuration. (See page 9-17, *Verify configuration*.)<br>• Check time zone offset configuration and time of day source. See the TG700 User manual for directions.<br>• Check diagnostics reported values. (See page 9-18, *Check diagnostic reported values*.)<br>• Run Acquire New Position procedure. (See page 9-22, *Acquire new position*.) |
| • No Black Burst outputs<br>• No LTC outputs | • Run power supply test.<br>• Verify configuration. (See page 9-17, *Verify configuration*.)<br>• Check diagnostics reported values. (See page 9-18, *Check diagnostic reported values*.)<br>• Swap modules/mainframes.<br>• If no other problem found, replace the GPS7 module. |
| • Long GPS lock time | • Check GPS antenna signal source. (See page 9-17, *Check GPS antenna signal source*.)<br>• Adjust oven oscillator. (See page 9-22, *Oven oscillator frequency adjustment*.)<br>• Adjust oscillator gain. (See page 9-8, *Gain calibration*.)<br>• Verify configuration. (See page 9-17, *Verify configuration*.)<br>• Check diagnostics reported values. (See page 9-18, *Check diagnostic reported values*.)<br>• If no other problem found, replace the GPS7 module. |

**Table 9-4: GPS7 module troubleshooting (cont.)**

| Problem | Actions |
|---|---|
| • Unstable genlock or unable to genlock | • Run Internal Mode Oven test. (See page 9-24, *Internal mode oven test*.)<br>• Check GPS7 reference select is set to correct mode. See the TG700 User manual for directions.<br>• Verify reference signal is valid and is the correct format. Use a WFM7120 or WFM8300 waveform monitor.<br>• Check ADC Bus diagnostics. (See page 9-25, *ADC bus diagnostics*.)<br>• Run Loop Out Reference test. (See page 9-26, *Loop output reference test*.)<br>• Swap modules/mainframes.<br>• If no other problem found, replace the GPS7 module. |
| • Unable to detect or use timecode | • Verify timecode is present on the input signal. Use a WFM7120 or WFM8300 waveform monitor.<br>• Verify GPS7 time source select is set to VITC. See the TG700 User manual for directions.<br>• Verify GPS7 time sync method is set as needed. The “Follow” mode is best for troubleshooting purposes. See the TG700 User manual for directions.<br>• Check the GPS7 status menu for the Genlock input amplitude and VITC present indicators. See the TG700 User manual for directions.<br>• Run Loop Out Reference test. (See page 9-26, *Loop output reference test*.)<br>• Swap modules/mainframes.<br>• If no other problem found, replace the GPS7 module. |

## Procedures

**Power on self test.** When you first apply power to a TG700, it runs a Power On Self Test (POST). If an error is encountered during this POST the display will show one of several error codes. (See Table 9-5.) Watch the display during boot up and note any error codes.

**Table 9-5: POST error codes**

| Error Code | Meaning | Action |
|---|---|---|
| 1: | CPLD constant 1 check (0xAAAA or 0x00AA based on cpld version at addr 0x8) | Try another GPS7 module in the mainframe slot 1. If you do not have another module, or if the 2nd module does not show an error code, return the GPS7 module for repair |
| 2: | CPLD constant 2 check (0x5555 or 0x0055 based on cpld version at addr 0xA) | |
| 3: | CPLD R/W error (writes 0x5555 to addr 0x102 and confirms) | |
| 4: | CPLD R/W error (writes 0xAAAA to addr 0x102 and confirms) | |
| 5: | Error copying DO Fpga to GPS7 EEPROM | |
| 7: | Error copying BB Fpga to GPS7 EEPROM | |
| 9: | DO Fpga constant check (0x55 at addr 0x501000) | |
| 10: | DO Fpga R/W error (writes 0x5555 to addr 0x501024 and confirms) | |
| 11: | DO Fpga R/W error (writes 0xAAAA to addr 0x501024 and confirms) | |
| 12: | BB Fpga R/W error (writes 0x5555 to addr 0x400008 and confirms) | |
| 13: | BB Fpga R/W error (writes 0xAAAA to addr 0x400008 and confirms) | |
| 14: | DO fpga Trimble Module communications error - GPS receiver is disconnected or failed | |
| 255: | Not an error. This code may appear following some firmware updates. | No action |

**Check installed software.** Use this procedure to check the installed software versions:

1. Access the Utilities menu.
   a. From the TG700 main menu, press the up (▲) or down (▼) arrow buttons to select **UTILITY**.
   b. Press the **ENTER** button to enter the utility submenu.
2. Access the Software Version information.
   a. Press the up (▲) or down (▼) arrow buttons to select **VERSION INFO (F/W) CPU [0]**.
   b. Read the firmware version.
3. If the CPU is not **Ver. 5.11** or later, then install current software. The latest software is available on the Web at www.tektronix.com/software.
4. Check that the GPS7 module version is v5.12 or later.
   a. Press the left (◄) or right (►) arrow buttons to select **GPS7 [1]**.
   b. Read the firmware version.
5. If the GPS7 software is not **Ver. 5.12** or later, then install current software. The latest software is available on the Web at www.tektronix.com/software.

**Verify configuration.** Before beginning any of these procedures, the GPS7 under test and the GPS7 reference unit must be configured to correctly use the GPS signal. If they do not have the correct configuration it will cause problems while troubleshooting.

The best way to ensure a common setup is to set both instruments to the factory presets:

1. Press the **MODULE** button until **TG700** appears.
2. Press **ENTER** to select **PRESET**.
3. If needed, use the up (▲) or down (▼) arrow buttons to select **Recall**.
4. Press the left (◄) arrow button until **Factory Preset** appears.
5. Press the **ENTER** button to load the preset.
6. When loading is complete, press the **CANCEL** button to exit the Factory Default menu.

When finished troubleshooting, disconnect and reconnect the power cord, to cycle the power. This will return the unit(s) to the user settings that were in effect before invoking the factory presets.

**Check GPS antenna signal source.** For proper operation, an outside antenna signal source must be connected to the GPS7 module, and functioning correctly. If a sufficient signal is not applied to the antenna connector, the GPS7 module will not operate properly. Use this procedure to verify the antenna signal:

1. Press the **MODULE** button to select **GPS7 [1]**.
2. If necessary, use the up (▲) or down (▼) arrow buttons to select **STATUS**.
3. Use the left (◄) or right (►) arrow buttons to select **Signal Quality**.

   Wait for the Signal Quality readout to stabilize. This may take several minutes.
4. Check **Signal Quality** and **Sats**.
5. If signal quality is ≥30 and the number of detected satellites is ≥4, then end this test. If not, then continue.

6. If the GPS7 module under test is the antenna power source, check that the GPS7 module is set to the correct antenna voltage:
   a. Press the up (▲) or down (▼) arrow buttons to select **GPS SETUP**.
   b. Press the **ENTER** button to enter the setup submenu.
   c. If necessary, use the up (▲) or down (▼) arrow buttons to select **ANTENNA POWER**.
   d. Check for proper antenna power setting.
   e. Check the **Antenna Power** LED. If the LED is red or blinking green, check for a problem with the antenna or the cabling system, such as an RF splitter that blocks or short circuits the antenna power DC voltage.
7. Check the DC antenna output power voltage. (See page 9-23, *DC antenna output power voltage*.)
8. Repeat steps 1 through 5 of this procedure for the reference unit. If the reference unit passes, then exchange antenna feeds between the reference unit and the GPS7 unit under test and retest the GPS7 unit under test.
9. If the GPS7 unit under test does not receive a GPS signal on a known, good, antenna, then replace the GPS7 module.

**Check diagnostic reported values.** There are several internally detected physical measurements which are reported by the GPS7 module. Check the following (see the *TG700 User* manual for detailed procedures).

- Temperature: Temperature is detected on the Trimble GPS receiver board. This temperature is normally about 15 °C above ambient temperature. If the temperature is very high or low, check that the fan is operating, the installation clearances are correct, and that all cables in the GPS7 module are connected properly. If there is still a problem, replace the GPS7 module.
- Tune – Phase: The Phase value indicates the second by second differences between the Pulse per Second (PPS) signal from the GPS receiver and the Local 1 PPS signal from the Master Time of Day clock. At lock this signal should be near hex 8000 0000.
- Tune – DAC: This indicates the current value written to the DAC on the Main board that controls the Oven Oscillator. The legal range for this value is 0 to 32,767, but when locked the value should be in the range of 6,000 to 20,000 to allow for fast locking and drift compensation. If the unit locks well but these values are out of this range, then replace the Main board.
- Voltage Mon 1 (+5V, +8V), Voltage Mon 2 (-5V rel to +3.3V): The voltage monitors measure the mainframe supplies, If the display indicates they are out of range, then check them manually. (See page 9-19, *Power supply test*.) If one of these supplies is bad, then replace the Main board. If manual

measurement shows that the supplies are correct, then the GPS7 module is not measuring them correctly. Replace the GPS7 module.

- PHASE DET RAMPS (Up: A, Up: B), PHASE DET RAMPS (Down: A, Down: B): These four values show critical values in the phase detector. The values may vary from unit to unit, as a result of the auto-calibration that adjusts them, but if all the power supplies are good and any of the ramp diagnostics indicate “WARN” (for Warning), then replace the GPS7 module.

**Power supply test.** There are two types of power supplies in the GPS7 module; those supplied by the TG700 mainframe and those that are derived on the GPS7 from the mainframe supplies. The ones supplied by the mainframe are fused on the GPS7 module; they have an 'M' at the start of the supply name. (See Table 9-6.) Derived supplies depend on the mainframe supply fuses for protection.

**Access.** To perform the power supply tests you must first remove the TG700 top cover. (See page 1-15, *Top Cover*.) Then use the following flowchart and table of power supply test points to determine if the GPS7 power supply is operating correctly. (See Figure 9-3.) (See Table 9-6.)

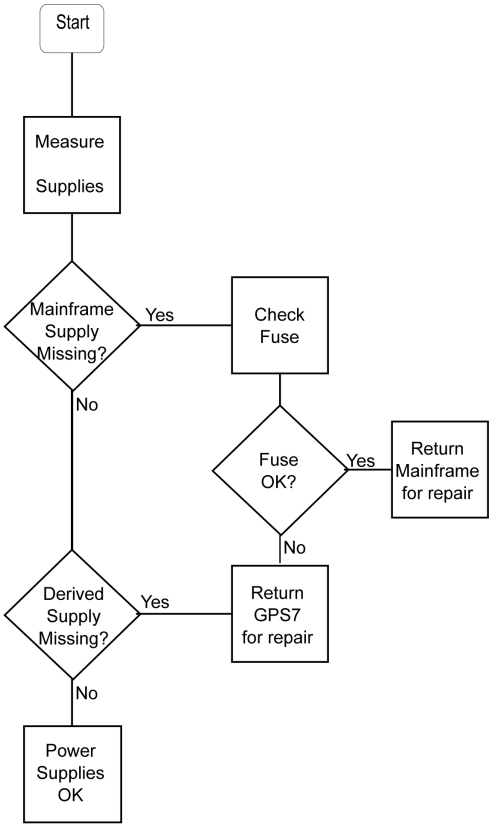



**Figure 9-3: GPS7 power supply test**

**Table 9-6: Power supply test points**

| Test point | Supply name | Limits | Notes |
|---|---|---|---|
| **Mainframe supplies** | | | |
| TP111 | M+5VD | +4.75 V to +5.25 V | Mainframe Fused 5 V digital supply, fuse F132 |
| TP211 | M+3.3V | +3.1 V to +3.5 V | Mainframe Fused 3.3 V digital supply, fuse F131 |
| TP213 | M–5VA | –4.75 V to –5.25 V | Mainframe Fused –5 V analog supply, fuse F111 |
| TP214 | M+5VA | +4.75 V to +5.25 V | Mainframe Fused +5 V analog supply, fuse F121 |
| TP215 | M+8V | +7.6 V to +8.4 V | Mainframe Fused +8 V analog supply, fuse F122 |
| **Derived supplies** | | | |
| TP311 | ANT+5V | 0 to 5.8 V | Switched GPS antenna supply – user setup |
| TP411 | RAMP+7V | 6.75 V to 7.25 V | Derived from M+8V |
| TP511 | RAMP-4V | -4.25 V to -3.75 V | Derived from M-5V |
| TP711 | CIR+2.5V | 2.375 V to 2.625 V | Derived from M+3.3V |
| TP911 | VID+4.1 | 4.08 V to 4.11 V | Derived from M+5VA |
| TP821 | LTC+3.3V | 3.30 V to 3.39 V | Derived from M+5VA |
| TP0821 | BB+1.2V | 1.15 V to 1.25 V | Derived from M+3.3V |
| TP0421 | DO+1.2V | 1.15 V to 1.25 V | Derived from M+3.3V, test point is under Trimble GPS receiver board |

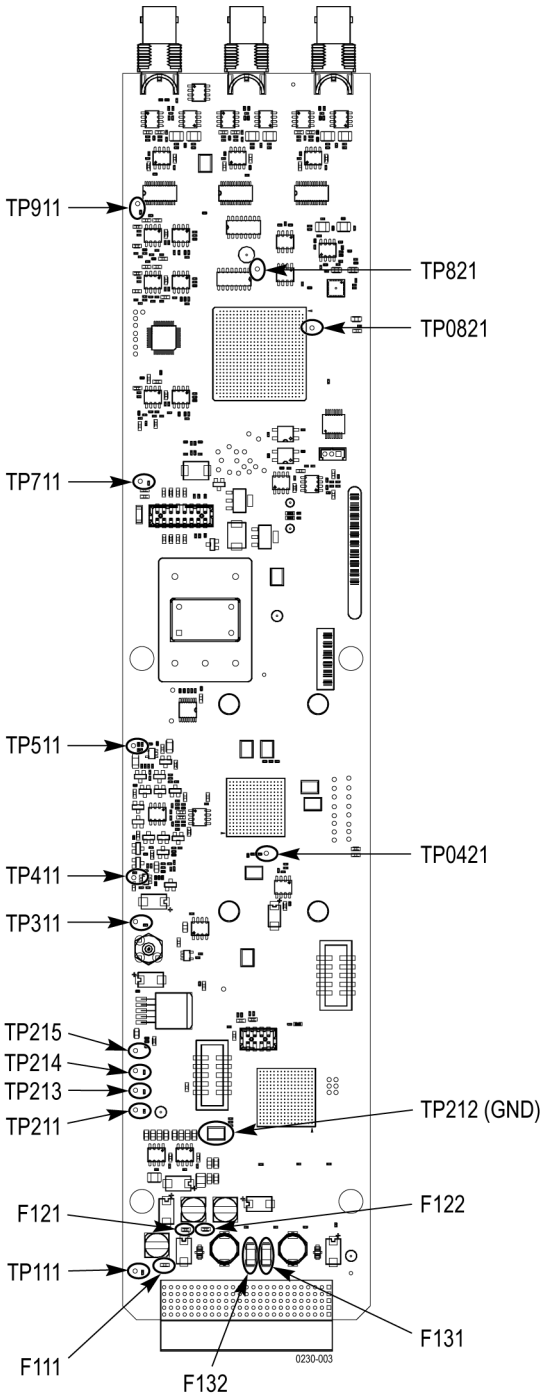



**Figure 9-4: GPS7 voltage test point and fuse locations**

**Oven oscillator frequency adjustment.** The oven oscillator frequency adjustment saves the current tune voltage for the oven. This will be used when the instrument is in “internal” mode. If the instrument is locked to a GPS signal, this should be done periodically to account for crystal drift. This adjustment can be done without any disruption to operation, and is best done in the instrument's operating environment. This adjustment can be done without putting the instrument into 'Factory Mode,' so the instrument does not have to be taken out of service.

1. Allow the instrument to warm up for a minimum of 20 minutes with a GPS signal connected.
2. Verify that the instrument is locked to the GPS signal.
3. Make sure the instrument is in “Fine” mode.
4. Navigate to TG700 Utilities: Oven frequency Calibration.
5. Press the **ENTER** button to save the current oven tune value.
6. Note the value displayed. Normally this value will be in the range of 12,000 to 14,000. If it is <6,000 or >20,000 then the oven is near the end of it's tune range, and the main board should be replaced.

**Gain calibration.** Perform a Gain calibration, as shown in the Adjustment Procedures, to characterize the oscillator frequency as a function of voltage. This adjustment needs to be performed in factory mode and is only needed once to characterize the oscillator. (See page 9-8, *Gain calibration*.)

**Acquire new position.** The GPS7 module must have a valid 3D GPS position to properly lock to GPS time. If the GPS antenna is moved, a new position must be acquired for correct time information. There must be a good antenna feed, and the GPS receiver must be locked to at least four GPS satellites for this procedure to complete successfully. The unit will require approximately 60 seconds to acquire a new position.

1. Navigate to GPS7:GPS SETUP:ACQUIRE POSITION, and then press the ENTER button.
2. Select GPS7:STATUS.
3. Wait until the status display shows Locked.
4. This process requires four satellites to complete successfully. If the signal is marginal the acquisition may take longer. If the signal is poor, or if there is no signal, the acquisition will not finish.

**DC antenna output power voltage.** The GPS7 module is capable of providing power to a GPS antenna. Use this procedure to verify that the GPS7 module is providing power correctly.

1. Disconnect the antenna from the GPS7 module.
2. Connect the voltmeter to the GPS7 Antenna input, using a coaxial cable, BNC T connector, and a BNC to Banana plug adapter. Do not connect a terminator at this time. The Antenna Power light should be blinking green.
3. Make note of the voltmeter reading, for later use.
4. Set the antenna voltage to 3.3 V.
5. Check the voltmeter reading. It should be between 3.1 V and 4.0 V.
6. Set the antenna voltage to 5 V.
7. Check the voltmeter reading. It should be between 5 V and 6 V.
8. Connect a 75 Ω precision terminator to the BNC T connector, to simulate a typical load. The Antenna Power light should change from blinking green to solid green.
9. Check the voltmeter reading. It should be between 4 V and 5 V.
10. If the GPS7 module does not provide the correct voltages, replace the GPS7 module.
11. Disconnect the cable from the GPS7 Antenna connector.
12. Reset the GPS7 module to the voltage noted in step 3, or to the correct voltage for the antenna in use.
13. Reconnect the antenna.

**Swap modules and mainframes.** If you have other TG700 modules or mainframes available, they can be used to help isolate problems.

- Swap the GPS7 module into slot 1 of another TG700 mainframe. If the GPS7 module works in that mainframe the problem is in the original mainframe.
- Swap a second GPS7 module into slot 1 of the test mainframe. If this module works in the test mainframe the problem is the original GPS7 module.
- Put a module of a different type into slot 1 of the test mainframe. An AGL7 module is a good one to use, as it uses most of the same signals as a GPS7 module. If that module works in the test mainframe then suspect the original GPS7 module, but the problem could still be in the mainframe.

**Internal mode oven test.** Perform this procedure to determine if the oven oscillator is working and within specifications.

1. Set the GPS7 module under test to internal reference mode.
   a. Press the **Module** button to select **GPS7 [1]**.
   b. Press the up (▲) or down (▼) arrow buttons to select **REFERENCE**, and then press the **ENTER** button.
   c. If necessary, press the up (▲) or down (▼) arrow buttons to select **SOURCE**.
   d. Press the left (◄) or right (►) arrow buttons to select **Internal**, and then press the **ENTER** button.
2. Use the frequency accuracy setup from the *TG700 Specifications and Performance Verification* manual (available on the Web at www.tektronix.com/manuals) to compare the Black Burst signals from the instrument under test to the reference unit. An alternate way to check frequency accuracy follows step 4.
3. Since the instrument under test is in internal mode the timing may shift. The vector will probably spin relative to the reference unit, which is locked to GPS.
4. Use the timing display to measure how fast the timing is shifting. A 1 µs shift per second equates to a 1 ppm difference in the time bases of the two units. Measure the timing shift for a reasonable time and then calculate the frequency error. For example, a 25 µs shift in 10 seconds = 25/10 = a 2.5 ppm error.

   Go to step 7.

   **Alternate procedure:**

   As an alternative to using a reference TG700/GPS7 unit, you can use a frequency counter to determine the frequency error.
5. Connect the frequency counter to the **BLACK 3** output.
6. Configure the **BLACK 3** output to produce a 10 MHz CW signal.
   a. Press the **MODULE** button to select **GPS7**.
   b. Use the up (▲) or down (▼) arrow buttons to select **SELECT OUTPUT**.
   c. Press the left (◄) or right (►) arrow buttons to select **BLACK 3**. Press the **ENTER** button to confirm this selection.
   d. If necessary, press the up (▲) or down (▼) arrow buttons to choose **SELECT FORMAT**.
   e. Use the left (◄) or right (►) arrow buttons to choose **CW 10 MHz**. Press the **ENTER** button to confirm this selection.
   f. Measure the frequency accuracy directly. At 10 MHz, 1 ppm = 10 Hz, so a measured frequency of 10,000,010 Hz is 1 ppm high.

7. If the difference is >1 ppm then the mainframe may need calibration, or the oven may not be able to tune to the correct frequency.
8. If the GPS7 module will lock to GPS, then perform an oven calibration. (See page 9-7, *Internal frequency calibration*.) If that fixes the problem then the system is functioning correctly.
9. If the GPS7 module will not lock but you have an AGL7 module, you can perform an oven calibration using that module. If that works then the mainframe oven is functioning correctly.
10. If the internal frequency is >3 ppm off, or steps 8 or 9 are not able to calibrate it to the correct frequency, then replace the mainframe.

**ADC bus diagnostics.** Perform this procedure to determine if all the bits on the ADC are properly connected to the FPGA logic.

***NOTE.*** *ADC bus diagnostics is only available on GPS7 modules with the REF IN connector on the rear panel.*

1. Ensure nothing is connected to the BLACK 1 / REF IN connector.
2. Go to the **REFERENCE** menu of the GPS7 under test.
3. Press the ENTER button.
4. You should see **SOURCE** in the menu. If you do not, press the down (▼) arrow button until it appears.
5. Press the right (►) arrow button until **Internal** appears, and then press the ENTER button.
6. Press the CANCEL button to exit the menu.
7. Press the down (▼) arrow button until **SELECT OUTPUT** appears.
8. You should see **BLACK 1** in the menu. If you do not, press the left (◄) arrow button until it appears, and then press the ENTER button.
9. You should see **INPUT-OUTPUT** in the menu. If you do not, press the down (▼) arrow button until it appears.
10. You should see **OUTPUT (if allowed)** in the menu. If you do, press the ENTER button. If you do not, press the right (►) arrow button until it appears in the menu, and then press the ENTER button.
11. Press the down (▼) arrow button until **SELECT FORMAT** appears in the menu, and then press the ENTER button.
12. You should see **NTSC** in the menu. If you do, press the ENTER button. If you do not, press the right (►) arrow button until it appears, and then press the ENTER button.

13. Press the right (►) arrow button until **Black Burst with Field REF** appears, and then press the ENTER button.
14. Press the CANCEL button twice to exit the menu.
15. Press the up (▲) arrow button until **DIAGNOSTICS** appears, and then press the ENTER button.
16. Press the right arrow button until **ADC BUS** appears.
17. Check for the following conditions:
    - If any bits in the *Stuck* field show an *H* or an *L*, then the bit is not moving. Replace the GPS7 module.
    - If any bits in the *Short* field show an *S*, then there is a short between some of the bits. Replace the GPS7 module.

**Loop output reference test.** Perform this procedure to view the reference input data looped out to the BLACK 2 connector. This can help determine correct functionality of the input circuitry or problems in the input signal.

***NOTE.*** *The loop output reference test is only available on GPS7 modules with the REF IN connector on the rear panel.*

1. At the same time, press the **MODULE**, **FORMAT**, and **FRONT PANEL ENABLE** buttons briefly, then continue to hold the **FRONT PANEL ENABLE** button until **TG700 Start up with factory mode** shows on the display.
2. Connect Black 1 of the reference unit to the Black 1 of the GPS7 module.
3. Connect the Black 2 of the GPS7 module to the composite input of the WRM7120 waveform monitor. Terminate the loop output on the WFM7120.
4. Configure the Reference Source of the GPS7 module to be NTSC Burst.
    a. Press the **MODULE** button until **GPS7** appears.
    b. Use the up (▲) or down (▼) arrow button to select **REFERENCE**.
    c. Press the ENTER button.
    d. Press the right (►) arrow button until **NTSC Burst** appears, and then press the ENTER button.
    e. Press the CANCEL button.

5. Configure Black 2 of the GPS7 module to Enable Loop Output from Black 1.

   a. Use the up (▲) or down (▼) arrow button to select **SELECT OUTPUT**.

   b. Press the right (►) arrow button until **BLACK 2** appears, and then press the ENTER button.

   c. Use the up (▲) or down (▼) arrow button to select **LOOP FROM BLACK1**.

   d. Press the right (►) arrow button until **Enable** appears, and then press the ENTER button.

   e. Press the CANCEL button.

6. Use the WFM7120 to examine the video. Check that the signal level is appropriate. The normal level is approximately twice the normal video size. Check for clipping or distortion of the signal. If the signal level is not appropriate or there is clipping or distortion, replace the GPS7 module.

# GPS7 Module Replaceable Parts List

This section contains a list of the replaceable modules for the GPS7 module. Use this list to identify and order replacement parts. For parts ordering or servicing information, see *Parts Ordering Information* or *Module Servicing* in the *TG700 Mainframe Replaceable Parts List* section of this manual. (See page 1-31, *TG700 Mainframe Replaceable Parts List*.)

## Abbreviations

Abbreviations conform to American National Standard ANSI Y1.1-1972.

### Table 9-7: GPS7 module – replaceable parts

| Fig. & index number | Tektronix part number | Serial no. effective | Serial no. discont'd | Qty | Name & description |
|---|---|---|---|---|---|
| 9-5-1 | 352-1117-00 | | | 1 | LIGHT PIPE SET:1 BD CONN, 1 LIGHT PIPE, 1 LENS |
| -2 | 174-5509-00 | | | 1 | CABLE,FEMALE SMB TO FEMALE BNC,8.0IN. |
| -3 | 214-3903-00 | | | 2 | *VENDOR: LYNTRON...SCREW, JACK; 4-40 X 0.312 LONG, 0.188 H HEX HEAD STAND OFF, 4-40 INT THD, X 0.312 THD EXT 4-40, STEEL, SN PLATED |
| -4 | 214-4946-01 | | | 2 | SPRING; CONICAL,VXI MOUNTING SCREW,0.26 MM SUS304,5.4 MML |
| -5 | 213-1129-01 | | | 2 | SCREW,MACHINE; M2.5 X 11MM L,PAN HD,STL,NI PL,CROSS REC & SLOTTED |
| -6 | 210-1039-00 | | | 3 | WASHER,LOCK; 0.521 ID,INT,0.025 THK, STEEL, ZINC FINISH |
| -7 | 220-0497-00 | | | 3 | NUT, PLAIN, HEX; .5-28 X .562 HEX, BRS, NI (NICKEL) PLATED |
| -8 | 333–4575-00 | B010100 | B019999 | 1 | PANEL, REAR; WITHOUT TIMECODE AND GENLOCK; SAFETY CONTROLLED |
| | 333–4575-01 | B020000 C020000 | | 1 | PANEL, REAR; WITH TIMECODE AND GENLOCK; SAFETY CONTROLLED |
| -9 | 441-2544-00 | | | 1 | CHASSIS, MODULE |
| -10 | 211-0408-00 | | | 8 | SCR, ASSY, WSHR; 4-40 X 0.250, PNH, STEEL, ZINC FINISH, T-10 TORX DR, SEMS |
| -11 | 116–1144–00 | B010100 | B019999 | 1 | MODULE ASSEMBLY; GPS7 WITHOUT TIMECODE AND GENLOCK |
| | 116–1157–00 | B020000 C020000 | | 1 | MODULE ASSEMBLY; GPS7 WITH TIMECODE AND GENLOCK |
| -12 | 174-5521-00 | | | 1 | CABLE, 2X4, 2MM PITCH, FEMALE TO FEMALE SQUARE PINS |
| -13 | 119–7518–00 | | | 1 | MODULE, GPS; TIMING, 1PPS +/-15NS; 3.3V, 0.35W, 1575.42 MHZ L1; 2.6 X 1.3 X 0.33, TRIMBLE RESOLUTION T |
| -14 | 174-5511-00 | | | 1 | CABLE, DSUB TO BOARD 15 CONDUCTOR |
| -15 | 343-1584-00 | | | 1 | CLAMP; WIRE ROUTING,0.51 H X 0.625W,NYLON |
| | | | **STANDARD ACCESSORIES** | | |
| | 075-0986-XX | | | 1 | MANUAL,TECH:MODULE INSTALLATION INSTRUCTIONS |
| | 063-3939-XX | | | 1 | KIT: SOFTWARE LIBRARY, DOCUMENTATION DVD |
| | | | **OPTIONAL ACCESSORIES** | | |
| | 003-A041-00 | | | 1 | NUT DRIVER,BOX:14MM HEX,BNC RETAINING NUT, MODIFIED 19MM |

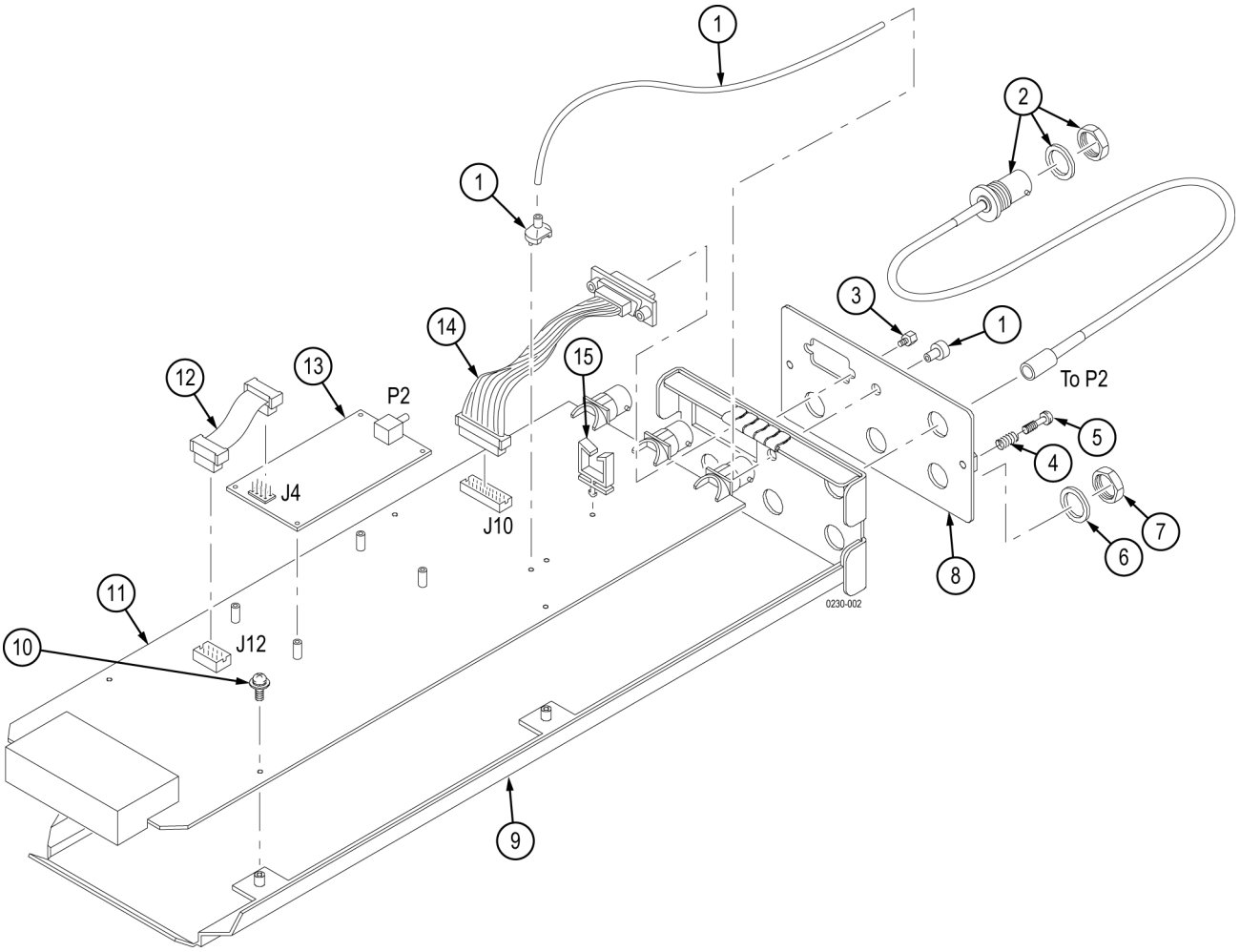



**Figure 9-5: GPS7 replaceable parts**

# HD3G7 HD 3 Gb/s SDI Video Generator Module

# HD3G7 HD 3 Gb/s SDI Video Generator Theory of Operation

This section describes the basic operation of the major circuit blocks in the HD3G7 module. The discussions relate to the Block Diagram. (See Figure 10-1 on page 10-3.)

There is some circuitry on the HD3G7 Main circuit board which is not used. Unused circuitry is not represented in the block diagram, nor is it discussed in this theory of operation.

## Overview

The HD3G7 module has three circuit boards: the main module board, which mounts horizontally and contains the bulk of the circuitry, and two small input and output boards. These input and output boards plug into the main board vertically and provide the rear BNC connections and the circuits required to buffer the high-speed I/O signals.

The heart of the HD3G7 generator is an FPGA, with other circuits that provide support and ancillary functions. There are two basic operational modes: Generator and Converter.

In generator mode the FPGA creates the output signal such as color bars or a ramp. The information to create the signals is completely contained within the FPGA. Serialization and scrambling is also done in the FPGA.

In converter mode an input signal at 1.5 Gb/s HD rate is up-converted to 3 Gb/s. De-serialization, up-conversion, and reserialization are all handled in the FPGA.

## FPGA and Associated Circuits

A Programmable Logic Device (PLD) configures the FPGA by loading a file from the Flash at power up. This configures the FPGA for normal operation; there is a separate file for calibration.

The CPU interface connects to both the PLD and FPGA. During SW upgrade, the Flash files are loaded from the mainframe via the PLD. The FPGA uses the CPU connection to access the control registers.

### Generator Mode

In generator mode, the FPGA contains horizontal and vertical counters which create the raster structure for the selected signal. These counters drive the FPGA elements that create the actual video signals such as color bars or flat field, along with the EAV and SAV info and the required CRCs. The video signals are then scrambled, serialized, and sent at the full 3 Gb/s out of the FPGA to the output boards.

### Converter Mode

In converter mode, the FPGA de-serializes and de-scrambles the 1.5 GHz input signal. Each active line from the input is used twice, to double the data rate for the output. The lines are multiplexed into the output according to the level A or B protocol, and then scrambled and serialized.

## Clocks and Frames

### Generator Mode

In generator mode, the mainframe provides three frame pulse signals. The actual frame signal used is the appropriate one for the rate of the signal being generated. The selected input frame resets the counters in the FPGA, establishing the correct video timing. These frames are not used in converter mode, as the converter output is always a slightly delayed version of the input signal.

The mainframe also provides a 54 MHz clock for generator mode. This 54 MHz clock drives a DDS in the FPGA to create a digitized sine wave, which is then applied to the flexible generator clock circuit. Depending on the output format the flexible clock output is at either 148.5 MHz or 148.35 MHz. This clock is fed back to the FPGA to drive the generator core functions, and sent to the FPGA serializer clock inputs and the trigger output multiplexer.

The 54 MHz input clock also registers the input frame pulse. After it is registered at 54 MHz it needs to cross to the 148.5 MHz domain. For this to work deterministically the phase of the two clocks is automatically controlled. The status of this automatic control system is shown in the module diagnostic menu as DDS1 phase.

### Converter Mode

In converter mode, the fixed 148.5 MHz Ref clock is used as a training clock in the input de-serializer. The FPGA then outputs a clock that was recovered from the input. This clock is passed through the jitter attenuator, to remove possible jitter from the HD input, and then, like the generator mode clock, it drives the serializer clocks and the trigger output multiplexer.

## Input and Output Boards

The input board contains a cable equalizer to accommodate various cable lengths. The equalizer output is sent to the FPGA. The input board also contains the trigger output. The user can select the active pixel clock, or if in generator mode, a pulse at either line or field rate. The output is 50 Ω, to drive typical oscilloscope inputs.

The output board takes two channels from the FPGA serializers and buffers them to drive 75 Ω cable. The output level is set by non-volatile electronic potentiometers on the output board, so the calibration is captured in the board.

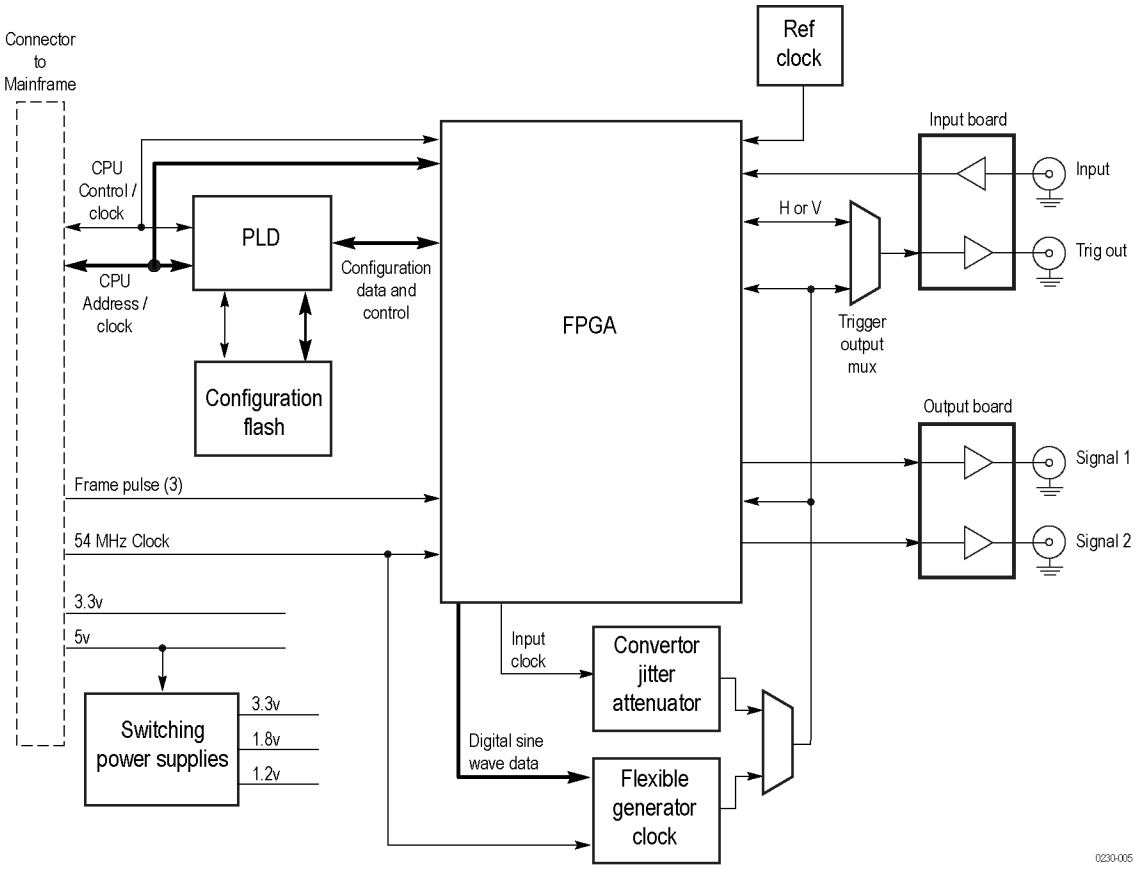



**Figure 10-1: Simplified block diagram of the HD3G7 Generator module**

## Power Supplies

There are three switching supplies, and several linear supplies in the module. Most of the power for the module comes in as 5 V and is converted to the voltage needed by the switching supplies. The mainframe supplies a small amount of 3.3 V for the processor interface, but the bulk of the 3.3 V used on the board is produced by the switching supply.

There are also 1.8 V and 1.2 V supplies, which are used for the memory and FPGA cores.

# HD3G7 HD 3 Gb/s SDI Video Generator Adjustment Procedures

The HD3G7 HD 3 Gb/s SDI Video Generator has one adjustments associated with it.

## Requirements for Adjustment

Before doing the adjustment, note the following requirements.

### Personnel

This procedure is only to be performed by trained service technicians.

### Warm-Up Period

The HD3G7 Generator module requires a 20 minute warm-up time in a +18 °C to +28 °C environment before it is adjusted. Adjustments done before the operating temperature has stabilized may cause errors in performance.

## Equipment Required

The following table lists the equipment required to perform the adjustments needed for this module.

**Table 10-1: Equipment required for HD3G7 HD 3 Gb/s SDI Video Generator adjustment procedures**

| Item | No. | Minimum requirement | Recommended equipment |
|---|---|---|---|
| TV signal generator platform | 1 | | Tektronix TG700 |
| Digital signal analyzer | 1 | Digital signal analyzer with a 20 GHz electrical sampling module and a probe interface module | Tektronix DSA8200 with an 80E04 electrical sampling module and an 80A03 Tek Connect Probe Interface module |
| Stable 10 kHz sine wave generator | 1 | CW sine wave with 800 $mV_{p-p}$ ±5% into 75 Ω, THD < 60 dBc, 10 kHz, and <50 mV DC offset | Tektronix AFG3101 |
| Tekconnect 75 Ω to 50 Ω adapter with BNC input connector | 1 | | Tektronix TCA75 |
| Precision RMS voltmeter | 1 | | Keithley 2700 DMM |
| 6 dB SMA attenuator | 1 | | Tektronix part number 015-1001-01 |
| SMA (male) to BNC (female) adapter | | | Tektronix part number 015-0554-00 |
| 1 m (3 ft.) BNC to BNC high-bandwidth cable | 1 | | Belden 1694, MarkerTek 1694-B-B-3 |

**Table 10-1: Equipment required for HD3G7 HD 3 Gb/s SDI Video Generator adjustment procedures (cont.)**

| Item | No. | Minimum requirement | Recommended equipment |
|---|---|---|---|
| 1 m (3 ft.) BNC to BNC 50 Ω cable | 1 | | Tektronix part number 012-0057-01 |
| 75 Ω precision terminator | 1 | 75 Ω ±0.1% | Tektronix part number 011-0102-03 |
| BNC T connector | 1 | | Tektronix part number 103-0030-00 |
| BNC female to dual banana adapter | 1 | | Tektronix part number 103-0090-00 |

## HD3G7 Module Adjustment Procedure

There is only one adjustment for the HD3G7 module. Perform this adjustment if the module fails the SDI Output Amplitude portion of the Performance Verification procedure. This procedure replicates part of the Performance Verification.

Before adjusting the SDI Output Amplitude you must first characterize the Reference to the DMM, and then characterize the test system.

### Characterization

**Characterize the reference to the DMM.**

1. Connect the equipment as follows:
   a. Connect the 1 m high-bandwidth cable to the AFG3101 output, and connect the BNC-T to the other end.
   b. Connect the 75 Ω precision terminator to the other end of the BNC-T, and connect the banana-plug adapter to the side.
   c. Connect the banana plug adapter to the DMM.
2. Set the AFG3101 for an 800 $mV_{p-p}$ 10 kHz sine wave into a 75 Ω load.
3. Check that the AFG3101 output is On.
4. Set the DMM to measure $AC_{RMS}$ Volts with a medium filter, and set the range to display four digits.
5. Record the DMM AC Voltage reading in the SDI Output Amplitude table. (See Table 10-2.)

Print this table for use during the Adjustment Procedure.

**Table 10-2: SDI output amplitude**

| | Minimum | Value | Maximum |
|---|---|---|---|
| **Characterization** | | | |
| DMM Measurement (typically 0.2880 V) | — — | | — — |
| Oscilloscope Cycle RMS (typically 116 mV) | — — | | — — |
| Oscilloscope Cycle Mean (typically 1 mV) | — — | | — — |
| Sine wave RMS amplitude (typically 116 mV) | $\sqrt{(Cycle\ RMS)^2 - (Cycle\ Mean)^2}$ | | — — |
| Attenuation Factor | 2.35 | | 2.55 |

| Adjustment Record | Value | | | |
|---|---|---|---|---|
| | Minimum | Before Adjustment | After Adjustment | Maximum |
| Expected direct (μ) | | — — | — — | — — |
| Signal 1 amplitude | | | | |
| Measured direct (μ) (typically 328 mV) | — — | | | — — |
| Calculated corrected value | 776 mV | | | 824 mV |
| Signal 2 amplitude | | | | |
| Measured direct (μ) (typically 328 mV) | — — | | | — — |
| Calculated corrected value | 776 mV | | | 824 mV |

**Characterize the test system.**

1. Set up the DSA8200:

***CAUTION.*** *Electrostatic discharge can damage the oscilloscope modules. To prevent damage, always work in a static free environment and discharge the static voltage from your body by wearing a grounded antistatic wrist strap while handling these modules.*

   a. Install the 80A03 output cable into the oscilloscope Channel 1/2 slot.

   b. Install the 80E04 sampling head into the 80A03 adapter, and connect the two using the semirigid SMA cables that come with the 80A03 adapter.

   c. Install the TCA-75 into the left port of the 80A03.

   d. If necessary, press the Default Settings button on the oscilloscope.

   e. Press the Channel 1 button on the 80E04 sampling head to activate Channel 1.

2. Connect the equipment as follows:

   a. Connect the 1 m high-bandwidth cable from the AFG3101 output to the TCA75 in the left port of the 80A03.

   b. Connect a 50 Ω cable from the AFG3101 trigger output, and connect the other end to the BNC to SMA adapter.

   c. Connect the BNC to SMA adapter to the 6 dB SMA attenuator, and connect the attenuator to the trigger input on the oscilloscope.

3. Keep the AFG3101 settings the same as in step 2 of the *Characterize the Reference to the DMM* procedure, above.

4. Set the oscilloscope:

   **Time/Div:** 20 µs
   **Volts/Div:** 50 mV
   **Averaging:** 16
   **Record Length:** 4000 points

5. On the oscilloscope, select measurement 1, then select pulse amplitude, and then select it to measure Cycle RMS. Record the value in the SDI Output Amplitude table. (See Table 10-2.)

6. On the oscilloscope, select measurement 2, then select pulse amplitude, and then select it to measure Cycle Mean. Record the value in the SDI Output Amplitude table. (See Table 10-2.)

7. Calculate the corrected RMS sine wave amplitude:
   $\sqrt{(cycle\ RMS)^2 - (cycle\ mean)^2}$

8. Record the result in the SDI Output Amplitude table. (See Table 10-2.)
9. Calculate the total system attenuation factor: $\frac{DMMmeasurement}{Corrected\ RMS\ sine\ wave\ amplitude}$.

   Record this total system attenuation factor in the SDI Output Amplitude table. (See Table 10-2.)

## Adjust SDI Output Amplitude

Use this procedure to adjust the SDI output amplitude:

1. Start the TG700 in factory mode:
   a. Press the **MODULE**, **FORMAT**, and **FRONT PANEL ENABLE** buttons simultaneously, then release the **MODULE** and **FORMAT** buttons. Continue to hold the **FRONT PANEL ENABLE** button until you see the **Startup with Factory Mode** message, then release the button.
2. Connect the 50 Ω cable from the HD3G7 **TRIGGER OUTPUT** connector, using the BNC to SMA adapter (with or without the 6 dB attenuator) to the oscilloscope Trigger Direct input.
3. Connect the 1 m high-bandwidth cable from the HD3G7 **Signal 1** output to the TCA75 adapter in the left port of the 80A03.
4. Press the TG700 **MODULE** button until **HD3G7:STATUS** appears in the display.
5. If necessary, press the up (▲) or down (▼) arrow buttons to choose **CALIBRATION**.
6. If necessary, use the left (◄) or right (►) arrow buttons to select **Output 1** to adjust the Signal 1 output, and then press the **ENTER** button.
7. Press the right (►) arrow button to select **20 Bits Square**, and then press the **ENTER** button.
8. If necessary, set the oscilloscope:

   **Time/Div:** 2 ns
   **Volts/Div:** 50 mV
   **Averaging:** 16
   **Record Length:** 4000 points
9. On the oscilloscope, select Measurement 3, Pulse-Amplitude, and then Amplitude to measure the amplitude on the flat part of the long pulse.
10. Right click on the measurement readout, and select **Show Statistics** from the pop-up menu.
11. Calculate the expected direct (μ) value: $\frac{800}{Total\ System\ Attenuation\ Factor}$ and record this value in the SDI Output Amplitude table. (See Table 10-2.)
12. Record the average value, which is indicated by the letter μ, in the *Measured direct (μ)* row *Before Adjustment* column of the SDI Output Amplitude table. (See Table 10-2.)

13. Multiply μ by the attenuation factor obtained at the end of system characterization, and enter the result in the *Calculated corrected value* row *Before Adjustment* column of the SDI Output Amplitude table. (See Table 10-2.)

14. Press the TG700 up (▲) or down (▼) arrow button, and then press the **Enter** button, to activate the adjustment mode.

15. Press the **Clear Data** button on the oscilloscope and wait about 5 seconds before proceeding to the next step.

16. Press the TG700 up (▲) or down (▼) arrow button to change the amplitude to the expected average value calculated in step 11.

17. Repeat steps 15 and 16 until the average direct value (μ) is within 1 mV of the corrected direct value, and then press the TG700 **Enter** button to save the new amplitude calibration value and exit the Channel 1 Adjustment mode.

18. Record the new measured direct value in the *After Adjustment* column of the SDI Output Amplitude table. (See Table 10-2.)

19. Calculate the corrected value: $After\ Adjust\ Value \times Total\ System\ Attenuation\ Factor$. Record the corrected value in the *Calculated corrected value* row *After Adjustment* column of the SDI Output Amplitude table. (See Table 10-2.)

20. Press the **Cancel** button to exit Channel 1 Calibration mode.

21. Move the 1 m high-bandwidth cable from the HD3G7 **Signal 1** output to the **Signal 2** output.

22. Use the left (◄) or right (►) arrow buttons to select **Output 2** to adjust the Signal 2 output, and then press the **ENTER** button.

23. Press the right (►) arrow button to select **20 Bits Square**, and then press the **ENTER** button.

24. Repeat steps 12 through 20 for the Signal 2 output.

25. Cycle the power on the TG700 to return the generator to normal operating mode.

# HD3G7 HD 3 Gb/s SDI Video Generator Maintenance

This section contains instructions and procedures for maintaining the HD3G7 module. Before following these procedures, read *Maintenance for Generators and Modules*. (See page xix.)

The following information can be found in this section:

- Removal and Replacement (See page 10-11.)
- Troubleshooting (See page 10-13.)

If the instrument does not function properly, troubleshooting and corrective measures should be taken immediately to prevent additional problems.

***NOTE.*** *Contact your local Tektronix representative for information on where to return your instrument if it requires repair during the warranty period.*

# HD3G7 3 Gb/s SDI Video Generator Removal and Replacement

This section contains instructions on how to remove and replace the customer replaceable parts of the HD3G7 module.

## Tools Required

**Table 10-3: Required tools for HD3G7 removal and replacement**

| Name | Description | Tektronix part number |
|---|---|---|
| Torque driver | Accepts 1/4 inch screwdriver bits. Torque range of 5 to 14 in/lb. | Standard tool |
| T10 TORX tip | TORX driver bit for T10 size screw heads | Standard tool |
| P1 Pozidriv tip | Pozidriv driver tip for P1 size screw heads | Standard tool |
| Flat or Phillips tip | Small tip for removing the module from the mainframe | Standard tool |
| 9/16 inch wrench | Wrench or deep nut driver, to remove nuts from BNC connectors | Standard tool |

## Remove the HD3G7 Module

Refer to the *Removing a Module* section to remove the HD3G7 module from the mainframe. (See page 1-41, *Removing a Module*.)

## Disassembly

Disassembly of the HD3G7 HD 3 Gb/s SDI Video Generator module is a straightforward process, and can be easily accomplished. Refer to the illustration in the *Replaceable Parts List* if necessary. (See Figure 10-5 on page 10-23.) Make sure to retain all the screws, fasteners, and fittings for reassembly.

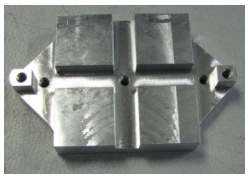
***NOTE.*** *The Input and Output circuit boards can only be separated from the Main board after the entire circuit board assembly has been removed from the chassis.*

## Reassembly

Reassembly is more complex than disassembly, and must be done in a specific order to prevent damage to the HD3G7 module. These procedures will start as if the instrument has been completely disassembled. You may start at an appropriate step and proceed to the end.

**Installing a new heat sink.** Follow this procedure to install a new heat sink. You will need a new gap pad as well as the heat sink.

1. Place the heat sink on the work surface as shown, with the bosses up.



2. Peel the protective film off of one side of the gap pad, and adhere the gap pad to the top of the heat sink.
3. Peel the protective film off of the top side of the gap pad.
4. Position the HD3G7 Main circuit board over the heat sink and gap pad, aligning the holes in the circuit board (on each side of the FPGA) with the threaded bosses of the heat sink. Press the circuit board down slightly to adhere the gap pad to the circuit board.
5. Loosely install two of the T10 TORX screws through the circuit board and into the heat sink.

***CAUTION.*** *To prevent damage to the FPGA, do not tighten these screws at this time.*

**Replace the circuit board into the chassis.** Follow this procedure to reinstall the circuit board assembly into the chassis.

1. Install the SDI Input circuit board (878-0199-xx) into J910 of the Main circuit board, and install the SDI Output circuit board (878-0200-xx) into J922 of the Main circuit board.
2. Slide the circuit board assembly onto the chassis, guiding the BNC connectors through the holes in the rear panel.
3. Loosely install the six T10 TORX screws that attach the Main circuit board to the chassis.

***CAUTION.*** *To prevent damage to the circuit boards and to the FPGA, do not tighten these screws at this time.*

4. If necessary, position the outer rear panel over the BNC connectors.
5. Install the three P1 Posidriv flathead screws, from the bottom through the chassis into the heat sink. Torque these screws to 5.0 in/lb.

6. Replace the washers and $^{9}/_{16}$ inch nuts onto the BNC connectors. Torque these nuts to 14.0 in/lb.

7. Tighten the eight T10 screws that attach the Main circuit board to the chassis and to the heat sink, in the sequence shown below. (See Figure 10-2.) Note that the two screws that attach the Main board to the heat sink are tightened last (7 and 8). Torque all these screws to 8.0 in/lb.

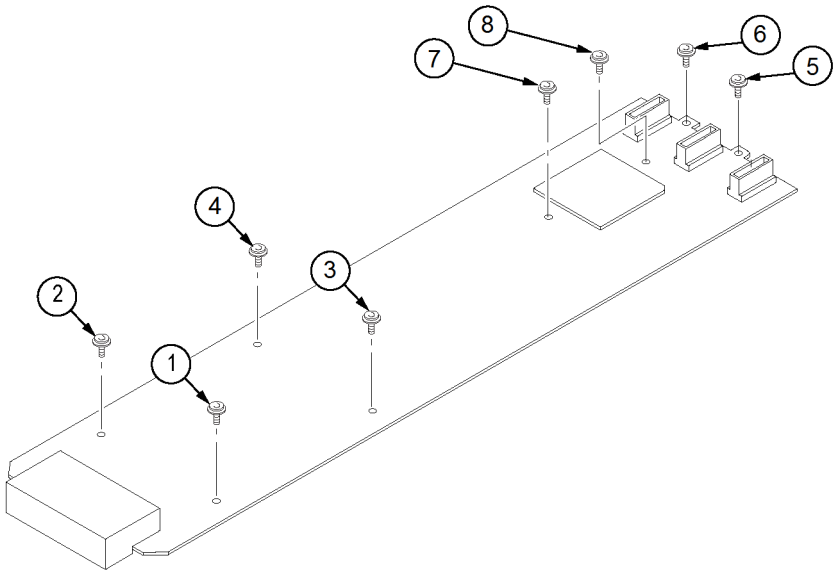



**Figure 10-2: HD3G7 main board installation**

The HD3G7 HD 3 Gb/s SDI Video Generator module is now ready to install in the mainframe.

## HD3G7 Troubleshooting

This section contains instructions and procedures to troubleshoot the HD3G7 HD 3 Gb/s SDI Video Generator module. These procedures will help you decide whether it is necessary to replace your module.

If the TG700 mainframe does not boot up or if the display is not working, refer to the *TG700 Mainframe Troubleshooting* section in this manual.(See page 1-24, *TG700 Mainframe Troubleshooting*.)

## Required Equipment

The equipment listed here is needed to troubleshoot the HD3G7 HD 3 Gb/s SDI Video Generator.

**Table 10-4: Equipment required to troubleshoot the HD3G7 module**

| Equipment | Requirement | Suggested equipment |
|---|---|---|
| TG700 mainframe | For the HD3G7 module under test | Tektronix TG700 |
| HD-SDI video signal generator | 1080 59.94i 100% Color Bars signal | Tektronix TG700 with HDVG7 generator module |
| HD Waveform monitor | Must be able to display 3 Gb/s SDI signal and jitter | Tektronix WFM7120 |
| Oscilloscope | >500 MHz bandwidth, 50 Ω input | Tektronix DPO4104 |
| Digital Multimeter | Used to check power supply voltages and fuses | Fluke 87 or equivalent |
| 75 Ω BNC cables (2) | Length: 42 inches, used to connect the instruments | Tektronix part number 012-0074-00 |
| 50 Ω BNC cable (1) | Length: 43 inches, used to test trigger output | Tektronix part number 012–0057–01 |
| ROHS compliant ESD safe soldering workstation | The HD3G7 boards do not contain any user-serviceable parts, but any soldering must be ROHS compliant | |
| Other TG700 modules | Used to test mainframe operation | BG7, AVG7, or DVG7 |

## Problem Identification

If there is a problem, first perform the HD3G7 Performance Verification procedure, found in the *TG700 TV Signal Generator Platform Specifications and Performance Verification* manual, available on the Web at www.tektronix.com/manuals. Any problems found with that procedure can be a starting point for troubleshooting.

General problems and actions to follow are shown in the following table.

**Table 10-5: HD3G7 troubleshooting**

| Problem | Actions |
|---|---|
| • Fails Power On Self Test (POST) | • Run power on test procedure. |
| • HD3G7 does not appear in menu | • Run power on in Factory mode test procedure. |
| | • Check for current software. |
| | • Run power supply test. |
| | • Perform swap modules procedure. |
| • No output from Signal BNCs | • Run power on test procedure. |
| | • Check diagnostics reported values. |
| | • Run power supply test. |
| | • Verify configuration. |
| | • Perform swap modules procedure. |
| • No signal at Trigger Output BNC | • Check diagnostics reported values. |
| | • Run Test Multiple Frame Rate procedure. |
| | • Verify configuration. |
| | • Check diagnostics reported values. |
| • CRC Errors in converter mode | • Run converter mode test procedure. |
| | • Run Check diagnostics procedure. |
| • Generator video color errors | • Verify configuration. |
| | • Perform swap modules procedure. |
| Generator Mode: | • Check diagnostics reported values. |
| • Unstable video | • Run Test Multiple Frame Rate procedure. |
| • Excessive jitter | |
| Converter Mode: | • Check diagnostics reported values. |
| • Unstable video | • Run converter mode test procedure. |
| • Excessive jitter | |
| • Generator output lost when format is changed | • Run Test Multiple Frame Rate procedure. |
| | • If no other problem found, replace the HD3G7 module. |

## Procedures

**Power on self test.** When you first apply power to a TG700, it runs a Power On Self Test (POST). If an error is encountered during this POST the display will show one of several error codes. (See Table 10-6.) Watch the display during boot up and note any error codes. Error codes may appear for as short a time as three seconds.

**Table 10-6: POST error codes**

| Error code | Meaning | Action |
|---|---|---|
| 1: | No input board in slot 0 - The input module is not detected by the processor. | Replace the Input module. |
| 2: | No output board in slot 2 - The output module is not detected by the processor. | Replace the Output module. |
| 3: | PLD keyword != 0xAAAA - The processor did not read the correct code interfacing to the module. | These errors indicate a failure of basic communications between the mainframe processor and the PLD on the module. If possible, try the module in another slot or mainframe. If that is not possible, or if that fails, then replace the HD3G7 module. |
| 4: | PLD keyword != 0x5555 - The processor did not read the correct code interfacing to the module. | |
| 5: | FPGA not configured | Check the SW version. If necessary, reload the Module flash that holds the FPGA configuration file. If the SW is current and correctly installed and this error is still encountered, then replace the HD3G7 module. |
| 6: | FPGA R/W check 0x55 failed (0x20040A) | These errors indicate the main processor cannot communicate with the FPGA on the HD3G7 module. If possible, try the module in another slot or mainframe. If that is not possible, or if that fails, then replace the HD3G7 module. |
| 7: | FPGA R/W check 0x55 failed (0x20040C) | |
| 8: | FPGA R/W check 0xAA failed (0x20040A) | |
| 9: | FPGA R/W check 0xAA failed (0x20040C) | |

**Check module diagnostics.** There are several internally detected physical measurements which are reported by the HD3G7 module diagnostics. Use this procedure to access the module diagnostics:

1. Press the **Module** button to select HD3G7 [x].
2. Press the up (▲) or down (▼) arrow buttons to choose **Diagnostics**, and then press the **Enter** button to enter the diagnostics submenu.
3. Press the left (◄) or right (►) arrow buttons to scroll through these diagnostic tests:

- **PLL Status:** Jit:Locked should be displayed in converter mode and Flex1:Lock should be displayed in generator mode. If the appropriate Locked message is not displayed when expected, it can indicate a problem with the module, or with the input clock from the mainframe, or with the input signal. Flex 0 is not used currently and may indicate lock or unlock.
- **DDS Status:** DDS1 Phase:Lock should be displayed when in generator mode. Lock or Unlk may be displayed when in converter mode. DDS0 is not used currently and may indicate lock or unlock.

- **CRC Errors:** Displays a count of errors detected on the converter input. Errors will occur at power up and should be cleared after an input is connected in converter mode.
- **Clear CRC Errors:** Press enter to clear the input CRC error counters.
- **Temperatures:** The HD3G7 module detects the temperature on the board. This temperature is normally about 15 °C above ambient temperature. If the temperature is very high or low, check that the fan is operating, the installation clearances are correct, and that all cables are connected properly. If there is still a problem, replace the HD3G7 module.
- **FPGA Version:** *Current:* shows the FPGA version that is loaded. *Expected:* shows the version that the operating firmware expects. If these are different, consider upgrading the software.
- **VOLTAGE MON (1, 2, 3, & 4):** All internal voltages except the mainframe +5 V supply are measured and displayed with "OK" if they are within the established limits. If any voltages are out of the established limits, the HD3G7 module must be replaced.
- **DDS SWEEP:** This diagnostic capability is available only in factory mode and is not used in normal module troubleshooting.

**Check installed software.** Use this procedure to check the installed software versions:

1. Access the Utilities menu.
   a. From the TG700 main menu, press the up (▲) or down (▼) arrow buttons to select **UTILITY**.
   b. Press the **ENTER** button to enter the utility submenu.
2. Access the Software Version information.
   a. Press the up (▲) or down (▼) arrow buttons to select **VERSION INFO (F/W) CPU [0]**.
   b. Read the firmware version.
3. If the CPU is not **Ver. 5.2** or later, then install current software. The latest software is available on the Web at www.tektronix.com/software.

4. Check that the HD3G7 module version is v5.21 or later.
   a. Press the left (◄) or right (►) arrow buttons to select **HD3G7 [1]**.
   b. Read the firmware version.
5. If the HD3G7 software is not **Ver. 5.21** or later, then install current software. The latest software is available on the Web at www.tektronix.com/software.

***NOTE.*** *Make sure to follow all the instructions to ensure that the FPGA configuration data is loaded into the module flash.*

**Verify configuration.** The HD3G7 can be configured to operate in either generator mode or converter mode, depending on your operational requirements. To eliminate the configuration as the source of a problem, set the module to the factory default:

1. If necessary, save the user configuration in a preset. (The user configuration may already be saved as the power on preset.)
2. Restore the factory default:
   a. Press the **MODULE** button until **TG700** appears.
   b. Press **Enter** to select **Preset**.
   c. Press the up (▲) or down (▼) arrow button to select **RECALL**.
   d. Press the left (◄) or right (►) arrow button to select **Factory Default**.
   e. Press the **ENTER** button to reset the instrument to the factory default settings.
   f. Press the **CANCEL** button to return the TG700 main menu.
3. Check to see if the problem still exists.

If the problem has been fixed, compare the settings between the factory default and the user configuration to find the issue. (See Table 10-7.)

**Table 10-7: HD3G7 module factory default settings**

| Men item name | Settings |
|---|---|
| STATUS | 1080 59.94p SMPTE Color Bars<br>3 Gb/s Level A YCbCr 4:2:2 10b |
| OUTPUT MODE | Level A |
| MOVING PICTURE | |
| H Step | 0 Sample(s) |
| V Step | 0 Line(s) |
| Period | 1 Frame(s) |
| Random | Disable |

**Table 10-7: HD3G7 module factory default settings (cont.)**

| Men item name | Settings |
|---|---|
| TIMING | |
| Vertical | 0 Line(s) |
| Horizontal | 0.0000 µs |
| VIDEO | |
| Y | ON |
| Cb | ON |
| Cr | ON |
| TRIGGER OUTPUT | System Clock |

**Check power supplies.** The module diagnostics check most of the power supplies, but there are two that need manual verification.

1. Remove the TG700 top cover. (See page 1-15, *Top Cover*.)
2. Check the +5 V supply by measuring the voltage at F121, which should be in the range of +4.75 V to +5.25 V. (See Figure 10-3.) This fuse is located under one of the mainframe support bars, and is difficult to access.
3. Check the +3.3 V supply by measuring the voltage at F122, which should be in the range of +3.135 V to +3.465 V. (See Figure 10-3.) This fuse is located under one of the mainframe support bars, and is difficult to access.

Make sure that the voltage is present on both ends of the fuse. If the voltage is present on only one end of the fuse the module must be replaced. If the voltage is not present on either end of the fuse, check the mainframe power and the connector between the module and the mainframe. If they are okay, the mainframe must be repaired.

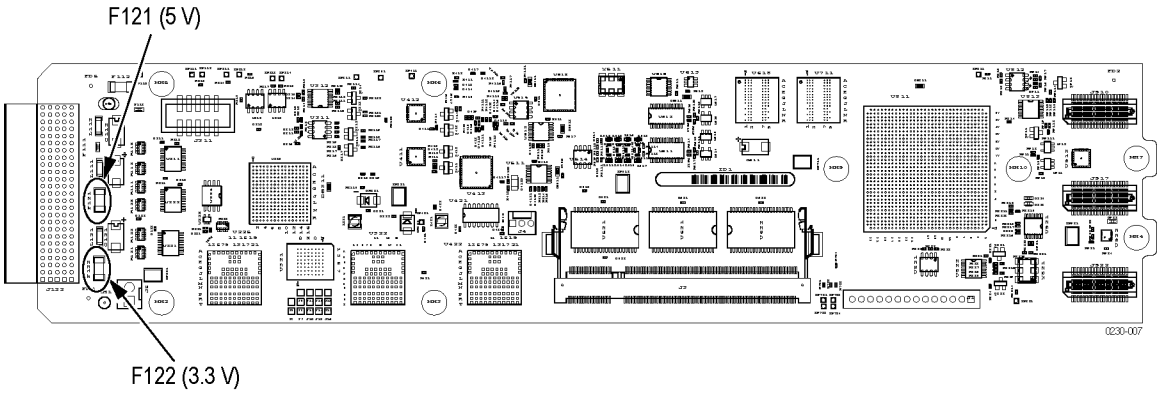



**Figure 10-3: HD3G7 power supply test points**

**Check multiple frame rates.** The mainframe provides three frame pulses which are used to set the module timing relative to the rest of the instrument. Different frame pulses are used, depending on the signal format the instrument is set for. Use this procedure to investigate problems in that circuitry.

1. Connect the HD3G7 outputs to a waveform monitor.
2. Apply power to the TG700 mainframe.
3. Recall the Factory Default preset as follows:
   a. Press the **MODULE** button until **TG700** appears.
   b. Press **Enter** button to select **Preset**.
   c. Press the up (▲) or down (▼) arrow button to select **RECALL**.
   d. Press the left (◄) or right (►) arrow button to select **Factory Default**.
   e. Press the **ENTER** button to reset the instrument to the factory default settings.
   f. Press the **CANCEL** button to return the TG700 main menu.
4. Verify that both HD3G7 outputs provide a 59.94, 1080p format, 75% color bar signal.
5. Check the DDS1:Phase lock status, as described in the Module Diagnostics. (See page 10-16, *Check module diagnostics*.)
6. Change the HD3G7 format to 60 Hz:
   a. Press the **MODULE** button to select the HD3G7 module.
   b. Press the **FORMAT** button to enter the HD3G7 format menu.
   c. Press the left (◄) or right (►) arrow button to select **1080 60p**.
7. Check the DDS1:Phase lock status, as described in the Module Diagnostics. (See page 10-16, *Check module diagnostics*.)

If one of the formats (59.94 Hz or 60 Hz) works correctly, but the other one does not, the mainframe sync pulse may be missing. Perform the *Swap Modules* procedure, below, to determine the source of the problem.

**Swap modules.** The interface between the mainframe and the module may make it difficult to determine whether the problem lies in the mainframe or in the module. Trying the HD3G7 module in another slot or in a known good mainframe is a simple way to quickly isolate which is at fault.

1. Try the HD3G7 module in a known good mainframe, or in another slot where a DVG7, BG7, or AVG7 module is known to work correctly. These modules use the same clocks and frame pulses. If the HD3G7 module works correctly here, replace or repair the original mainframe.
2. Try another HD3G7 module (or a DVG7, BG7, or AVG7 module, all of which use the same clocks and frame pulses) in the same mainframe and slot. If another module works correctly in the original slot, then replace the HD3G7 module.

**Converter mode test.** Follow this procedure if there is a problem when the HD3G7 module is set for converter mode:

1. Confirm that the input signal is present and that the format is compatible with the selected output. Specifically the input must be interlace video at the same frame rate as the progressive output (same frame rate: 50, 59.94, or 60 Hz).
2. Remove and reconnect the input signal a few times to see if that clears the problem.
3. Verify the input is good:
   a. Apply the input signal directly to the WFM7120.
   b. Check for general status problems, correct format, EDH errors, and excessive jitter.
4. If the HD3G7 status screen continues to report "Input Signal Unlocked" check the input module "NO_INPUT_DETECT" test point, along the top edge of the input board. If the voltage on the test point is low, an input is detected and the fault is probably on the main module board.

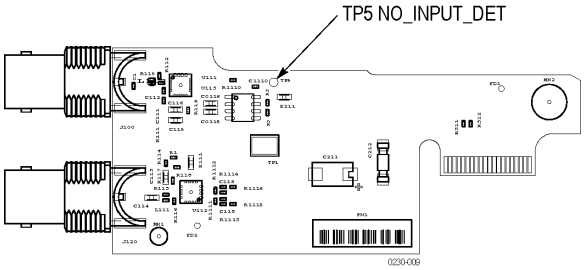



**Figure 10-4: No_Input_Detect test point location**

**Power up in factory mode.** Putting the instrument into factory mode allows access to calibration, but it also allows the module to show in the menus even if it fails the POST routine.

1. Press the **MODULE**, **FORMAT**, and **FRONT PANEL ENABLE** buttons simultaneously, then release the **MODULE** and **FORMAT** buttons. Continue to hold the **FRONT PANEL ENABLE** button until you see the **Startup with Factory Mode** message, then release the button.
2. Run the **Check module diagnostics** routine. (See page 10-16, *Check module diagnostics*.)

# HD3G7 HD 3 Gb/s SDI Video Generator Replaceable Parts List

This section contains a list of the replaceable modules for the HD3G7 Generator module. Use this list to identify and order replacement parts. For parts ordering or servicing information, see *Parts Ordering Information* or *Module Servicing* in the *TG700 Mainframe Replaceable Parts List* section of this manual. (See page 1-31, *TG700 Mainframe Replaceable Parts List*.)

This section contains a list of the replaceable parts and modules for the HD3G7 Generator module. Use this list to identify and order replacement parts.

## Abbreviations

Abbreviations conform to American National Standard ANSI Y1.1-1972.

**Table 10-8: HD3G7 HD 3 Gb/s SDI Video Generator – replaceable parts**

| Fig. & index number | Tektronix part number | Serial no. effective | Serial no. discont'd | Qty | Name & description |
|---|---|---|---|---|---|
| 10-5-1 | 116-1146-00 | | | 1 | MODULE ASSEMBLY; HD3G7 |
| -2 | 211-0408-00 | | | 8 | SCR, ASSY, WSHR; 4-40 X 0.250, PNH, STEEL, ZINC FINISH, T-10 TORX DR, SEMS |
| -3 | 878-0199-00 | | | 1 | CIRCUIT BD SUB-ASSEMBLY; ;SDI INPUT;389409500 WIRED |
| -4 | 878-0200-00 | | | 1 | CIRCUIT BD SUB-ASSEMBLY; ;SDI OUTPUT;389409600 WIRED |
| -5 | 131-M057-00 | | | 4 | CONN,RF:PCB,FEMALE,BNC,75OHM,EDGE LAUNCH TYPE |
| -6 | 348-1944-00 | | | 1 | GAP PAD 3000S30 |
| -7 | 214-5166-00 | | | 1 | HEATSINK, PCB TO CHASSIS |
| -8 | 441-2555-00 | | | 1 | CHASSIS, MODULE |
| -9 | 333-4576-00 | | | 1 | PANEL, REAR; SAFETY CONTROLLED |
| -10 | 214-4946-01 | | | 2 | SPRING; CONICAL,VXI MOUNTING SCREW,0.26 MM SUS304,5.4 MML |
| -11 | 213-1129-01 | | | 2 | SCREW,MACHINE; M2.5 X 11MM L,PAN HD,STL,NI PL,CROSS REC & SLOTTED |
| -12 | 220-0497-00 | | | 4 | NUT, PLAIN, HEX; .5-28 X .562 HEX, BRS, NI (NICKEL) PLATED |
| -13 | 210-1039-00 | | | 4 | WASHER,LOCK; 0.521 ID,INT,0.025 THK, STEEL, ZINC FINISH |
| -14 | 211-0101-00 | | | 3 | SCREW, MACHINE; 4-40 X 0.25, FLH, 100 DEG, ZINC PLATED STEEL, T8 |

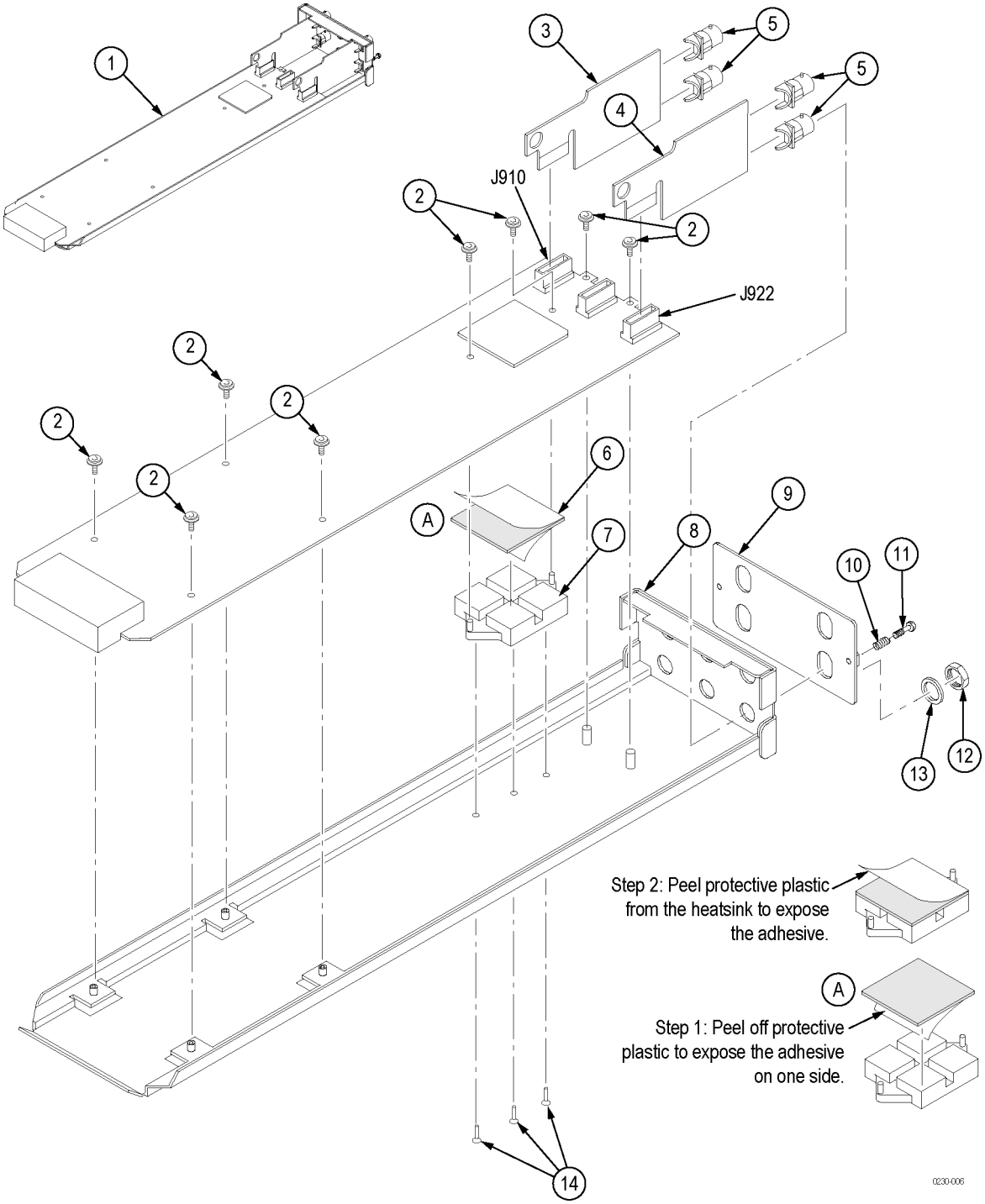



**Figure 10-5: HD3G7 HD 3 Gb/s SDI Video Generator – replaceable parts**

### Table 10-9: HD3G7 main board – replaceable parts

| Fig. & index number | Tektronix part number | Serial no. effective | Serial no. discont'd | Qty | Name & description |
|---|---|---|---|---|---|
| 10-6-1 | 159-5022-00 | | | 3 | FUSE; 5.0A,125V;FAST BLOW,0.1 X 0.1 X 0.24,UL REG,CSA CERT;451005,SAFETY CONTROLLED |
| -2 | 159-0463-00 | | | 2 | FUSE; SMD:2A,32V,FAST ACTING,0.024 OHM,0603 SIZE,UL/CSA REG,SAFETY CONTROLLED,TAPE & REEL,5000PCS,PB FREE |
| -3 | 131-8270-00 | | | 3 | CONN, EDGECARD, PCB, STRAIGHT, FEMALE, SOCKET, 2X20, 40 POS, HIGH SPEED, 0.8MM PITCH, 0.062 BOARD, SMT, SAMTEC MEC8-120-02-L-D-DV -A - K |

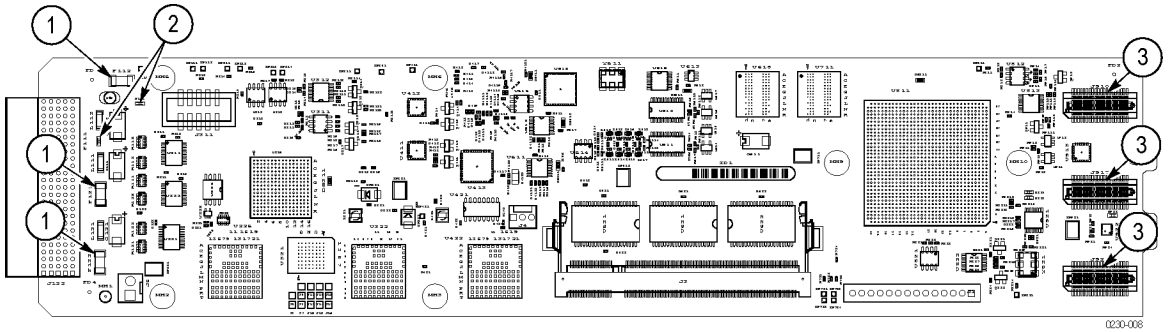



Figure 10-6: HD3G7 main board – replaceable parts

# HDLG7 HD Dual Link Video Generator

# HDLG7 HD Dual Link Video Generator Theory of Operation

This section describes the basic operation of the major circuit blocks in the HDLG7 module.

### Bus Interface

This block provides the communication between the mainframe and the module circuit.

### Deserializer

This block contains a cable equalizer and deserializer circuit that converts the HDTV Serial Digital Input signal to a 20-bit parallel video signal with the recovered parallel clock. The circuitry also detects the presence of input signal and identifies the format and rate of the incoming signal.

### Signal Processing

The Signal Processing block up-interpolates the Cb and Cr data and then color-space converts the incoming video signal to RGB. 4:4:4 YCbCr and RGB signals are available at the output of this block. If XYZ is desired as the output, the gamma correction is removed from the RGB data and the data is color-space converted to linear XYZ data. The linear XYZ data is then converted using the digital cinema gamma correction factor.

### Converter Formatter

This block allows selection of the output sample structure, separating the video data into the dual link format, reinsertion of EAV/SAV data to the two output signals, and adding incoming ancillary data and embedded audio to the Link A output video signal.

### Address Generator

This block consists of sample and line counters that can be frame delayed from a frame reference pulse using the MPU interface. The counter outputs are used to control the signal generation.

### Signal Generator Engine

The Signal Generator Engine contains circuitry to generate the selected test signal and the EAV and SAV blanking data using the sample and line counts from the Address Generator.

### Generator Formatter

The Generator Formatter separates the generated video into two output signals (Link A and Link B).

### Link A Serializer

The Link A Serializer block transforms the selected 20-bit parallel video signal (converted or generated) to a serial digital signal and drives a 75 Ω BNC output. In addition, CRC, line numbers, and payload packet are generated and inserted within this block.

### Link B Serializer

The Link B Serializer block transforms the selected 20-bit parallel video signal (converted or generated) to a serial digital signal and drives a 75 Ω BNC output. In addition, CRC, line numbers, and payload packet are generated and inserted within this block.

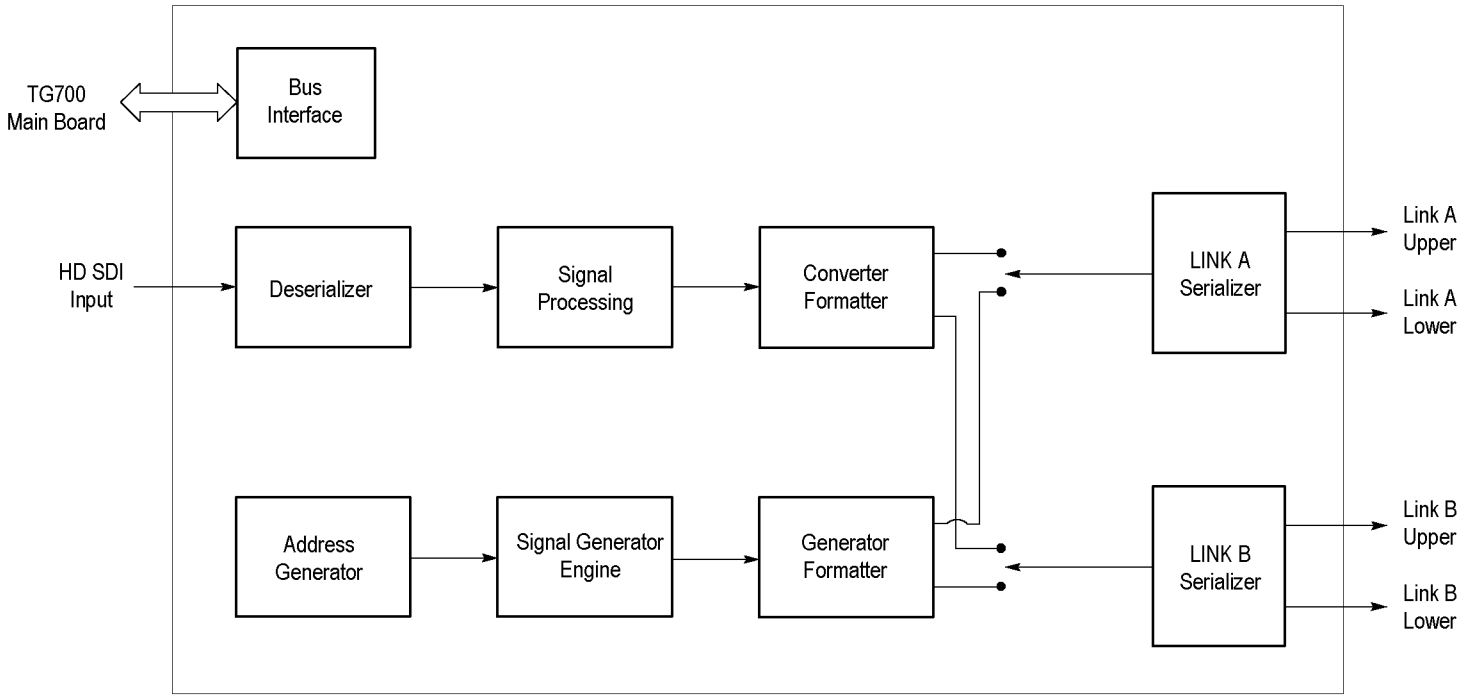



**Figure 11-1: Simplified block diagram of the HDLG7 module**

# HDLG7 HD Dual Link Video Generator Maintenance

This section contains instructions and procedures for maintaining the HDLG7 module. Before following these procedures, read *Maintenance for Generators and Modules*. (See page xix.)

The following information can be found in this section:

- Removal and Replacement (See page 11-4.)
- Troubleshooting (See page 11-6.)

If the instrument does not function properly, troubleshooting and corrective measures should be taken immediately to prevent additional problems.

***NOTE.*** *Contact your local Tektronix representative for information on where to return your instrument if it requires repair during the warranty period.*

# HDLG7 HD Dual Link Video Generator Removal and Replacement

This section contains the instructions on how you can remove and replace the customer replaceable parts of the HDLG7 module.

## Tools Required

The following tools are required to perform the removal and replacement procedures:

**Table 11-1: Required tools for removal and replacement of HDLG7 HD Dual Link Video Generator**

| Name | Description | Tektronix part number |
|---|---|---|
| Screwdriver handle | Accepts Phillips-driver bits | |
| #1 Phillips tip | Phillips-driver bit for #1 size screw heads | |
| #2 Phillips tip | Phillips-driver bit for #2 size screw heads | |
| Nut driver, 14 mm | Special nut driver for removing the BNC connectors of the HDLG7 module | 003-A041-00 |

## Replacing the Rear-Panel Connectors and Chassis

It is usually not necessary to replace the rear-panel connectors, or chassis. However, if a connector or chassis becomes damaged, you can replace it.

### Replacing the Rear-Panel Connectors

Perform the following procedure to replace the rear-panel connector:

1. Use the *Removing a Module* section to remove the HDLG7 module from the mainframe. (See page 1-41, *Removing a Module*.)
2. Disconnect the cables at J911 (upper LINK A), J912 (lower LINK A), J922 (upper LINK B), J921 (lower LINK B), and J711 (HD SDI IN) on the HDLG7 circuit board.
3. Use the 14 mm nut driver to remove the nut securing the damaged connector to the chassis. Pull the connector away.
4. Perform steps 2 and 3 in reverse order to replace the connector.

## Replacing the Chassis

Perform the following procedure to replace the chassis:

1. Use the 14 mm nut driver to remove the nuts from each of the rear-panel connectors.
2. Use a screwdriver with a #2 Phillips tip to remove the six screws securing the circuit board to the chassis.
3. Lift the circuit board up and away from chassis, and then place it on a static free surface.
4. Set the replacement chassis on a firm, flat, static-free work surface.
5. Carefully place the circuit board in place on the chassis.
6. Use a screwdriver with a #2 Phillips tip to install the six screws securing the circuit board to the chassis.
7. Apply the rear panel to the chassis, and then install all the rear-panel connectors to the chassis.

# HDLG7 HD Dual Link Video Generator Troubleshooting

This section contains instructions and procedures for troubleshooting the HDLG7 module. These procedures will help you decide whether it is necessary to replace your module.

If the TG700 mainframe does not boot up or if the display is not working, refer to the *TG700 Mainframe Troubleshooting* section in this manual.(See page 1-24, *TG700 Mainframe Troubleshooting*.)

## Equipment Required

The equipment listed in the following table is required for troubleshooting.

**Table 11-2: Equipment required for HDLG7 HD Dual Link Video Generator troubleshooting**

| Equipment description | Minimum requirements/example |
|---|---|
| Screwdriver handle | Accept Phillips-driver bits |
| #1 Phillips tip | Phillips-driver bit for #1 size screw heads |
| TG700 mainframe | A TG700 mainframe that is functioning correctly |

## Backing Up the Instrument Settings

Before you begin the troubleshooting procedures, create a preset to save your instrument settings as follows:

1. Press the **MODULE** button until the mainframe main menu (TG700: PRESET) appears.
2. Press the **ENTER** button to access the PRESET submenu.
3. Press the up (▲) or down (▼) arrow button to select **SAVE**.
4. Press the left (◄) or right (►) arrow button to select a preset number to save instrument settings.
5. Press the **ENTER** button to save the current instrument settings to the new preset.

After the problem is solved, recall the preset you created.

## Troubleshooting Trees

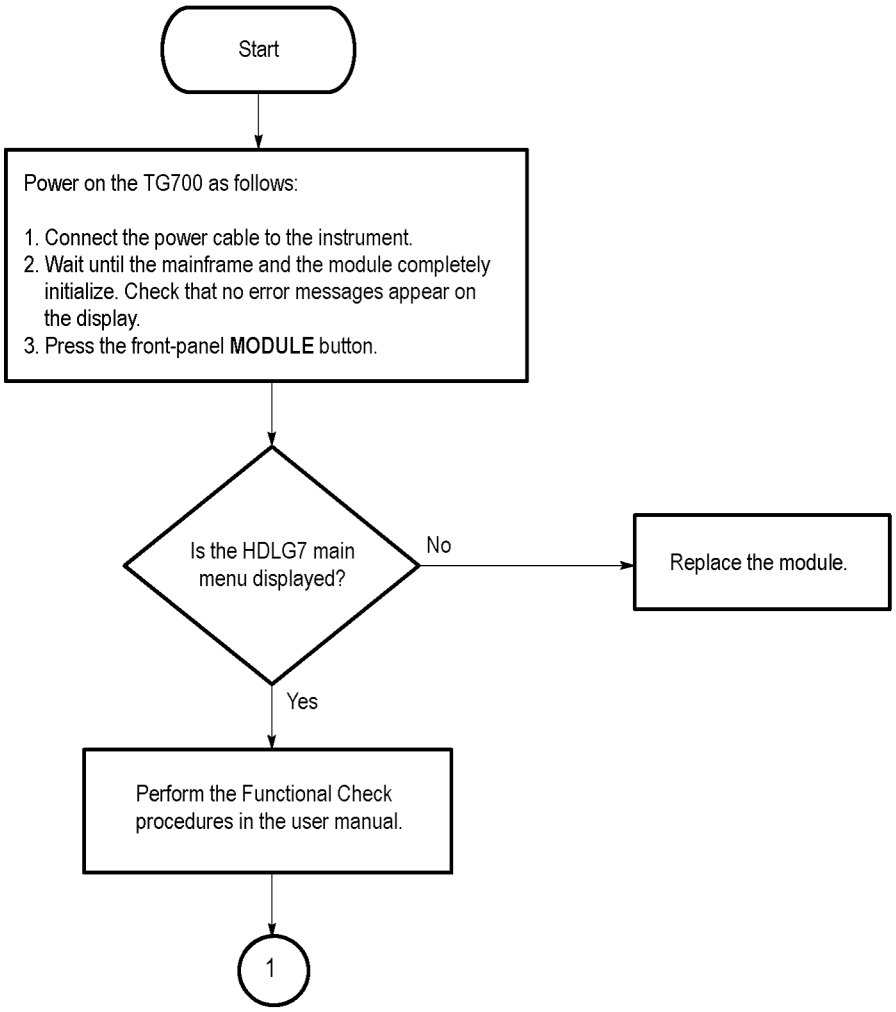

Start
Power on the TG700 as follows:
1. Connect the power cable to the instrument.
2. Wait until the mainframe and the module completely initialize. Check that no error messages appear on the display.
3. Press the front-panel MODULE button.
Is the HDLG7 main menu displayed?
No
Replace the module.
Yes
Perform the Functional Check procedures in the user manual.
1

**Figure 11-2: Troubleshooting procedure (1)**

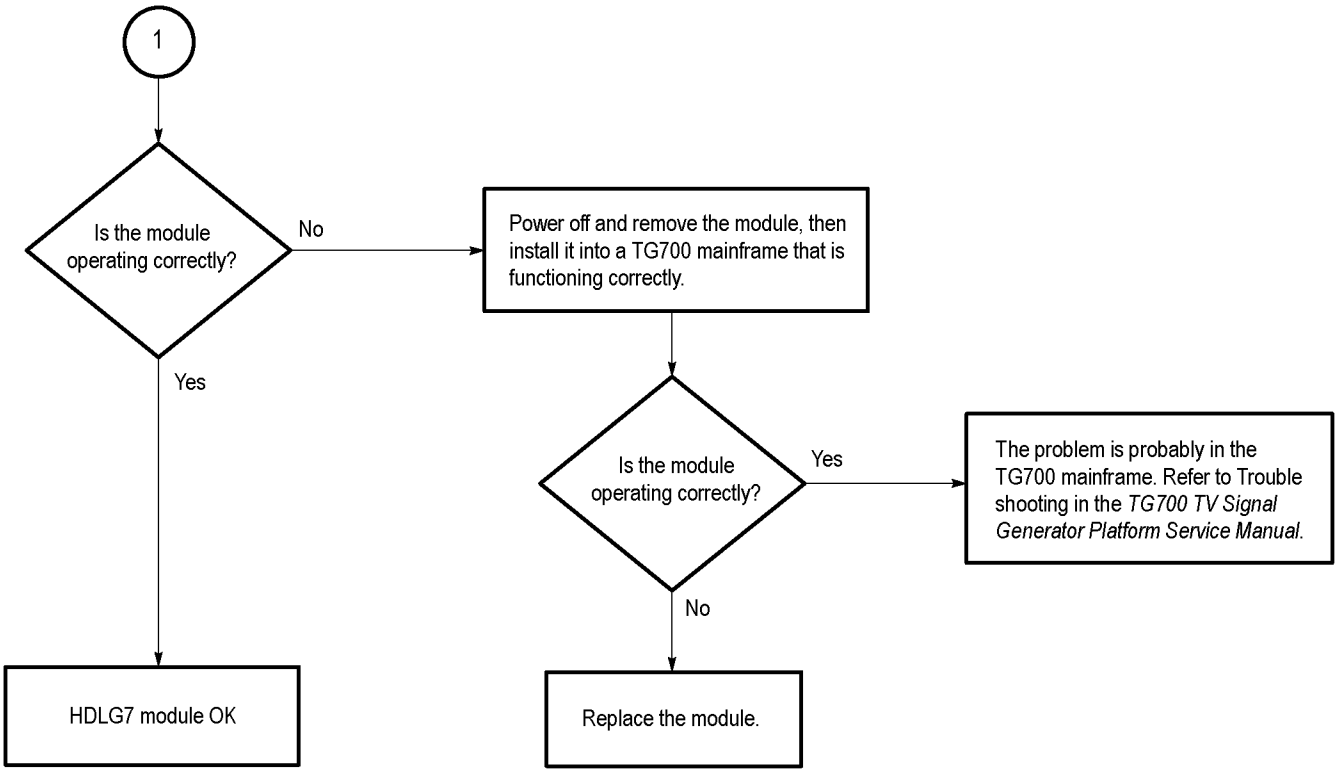

1
Is the module operating correctly?
No
Power off and remove the module, then install it into a TG700 mainframe that is functioning correctly.
Yes
Is the module operating correctly?
Yes
The problem is probably in the TG700 mainframe. Refer to Trouble shooting in the TG700 TV Signal Generator Platform Service Manual.
No
HDLG7 module OK
Replace the module.

**Figure 11-3: Troubleshooting procedure (2)**

# HDLG7 HD Dual Link Video Generator Diagram

The following figure shows the HDLG7 module and how it interconnects with the TG700 TV Signal Generator Platform.

Diagrams showing mainframe component interconnections, such as power supply and oscillator, can be found in the *TG700 Diagram* section of this manual. (See page 1-28, *TG700 Mainframe Diagrams*.)

A block diagram of the HDLG7 module is located in the *HDLG7 Theory of Operation* section. (See page 12-1.)

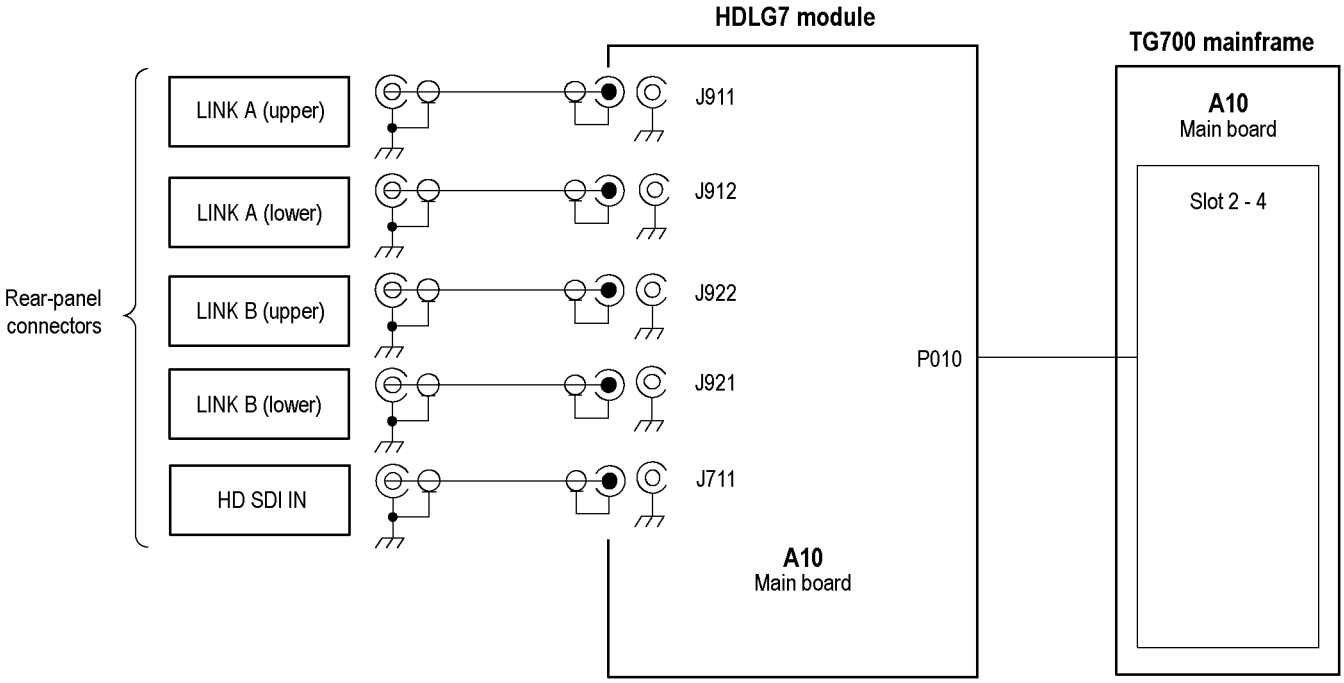



**Figure 11-4: HDLG7 module connections**

# HDLG7 HD Dual Link Video Generator Replaceable Parts List

This section contains a list of the replaceable modules for the HDLG7 module. Use this list to identify and order replacement parts.

## Abbreviations

Abbreviations conform to American National Standard ANSI Y1.1-1972.

### Table 11-3: HDLG7 HD Dual Link Video Generator – replaceable parts

| Fig. & index number | Tektronix part number | Serial no. effective | Serial no. discont'd | Qty | Name & description |
|---|---|---|---|---|---|
| 11-5-1 | 441-A269-02 | | | 1 | CHASSIS ASSY;MAIN,AGL7,AL,W/GASKET;SAFETY CONTROLLED |
| -2 | 333-4528-00 | | | 1 | PANEL,REAR:HDLG7,SAFETY CONTROLLED |
| -3 | 214-4946-00 | | | 2 | SPRING,CONICAL:VXI MOUNTING SCREW,0.26MM |
| -4 | 213-1129-01 | | | 2 | SCREW,MACHINE:M2.5X11MM L,PAN HD,STL,NI PL,CROSS REC & SLOTTED |
| -5 | 348-A156-01 | | | 1 | GASKET,SHIELD;FINGER TYPE,BE-CU,8.13MM W X 2.79MM H X406.4MM L] |
| -6 | 174-5277-00 | | | 5 | CABLE,RF,75 OHM;110MM,BNC TO MCX75 |
| -7 | 211-A245-01 | | | 5 | SCREW,MACHINE:M3X6MM L,PNH,STL,NI PL,CROSS REC,W/NUT & amp;LOCK WASHER,TG700,TG700 OPT FP, AG7, AGL7, BG7, DVG7, HDVG7 |
| -8 | 671-6184-00 | | | 1 | CIRCUIT BD ASSY;DUAL LINK GENERATOR/CONVERTER,TESTED,WIRED 389386000 |
| -9 | 334-1378-03 | | | 1 | MARKER,IDENT:MKD SERIAL NO. |
| | | | **STANDARD ACCESSORIES** | | |
| | 075-0986-XX | | | 1 | MANUAL,TECH:MODULE INSTALLATION INSTRUCTIONS |
| | 063-3939-XX | | | 1 | KIT: SOFTWARE LIBRARY, DOCUMENTATION DVD |
| | | | **OPTIONAL ACCESSORIES** | | |
| | 003-A041-00 | | | 1 | NUTDRIVER,BOX:14MM HEX,BNC RETAINING NUT, MODIFIED 19MM |

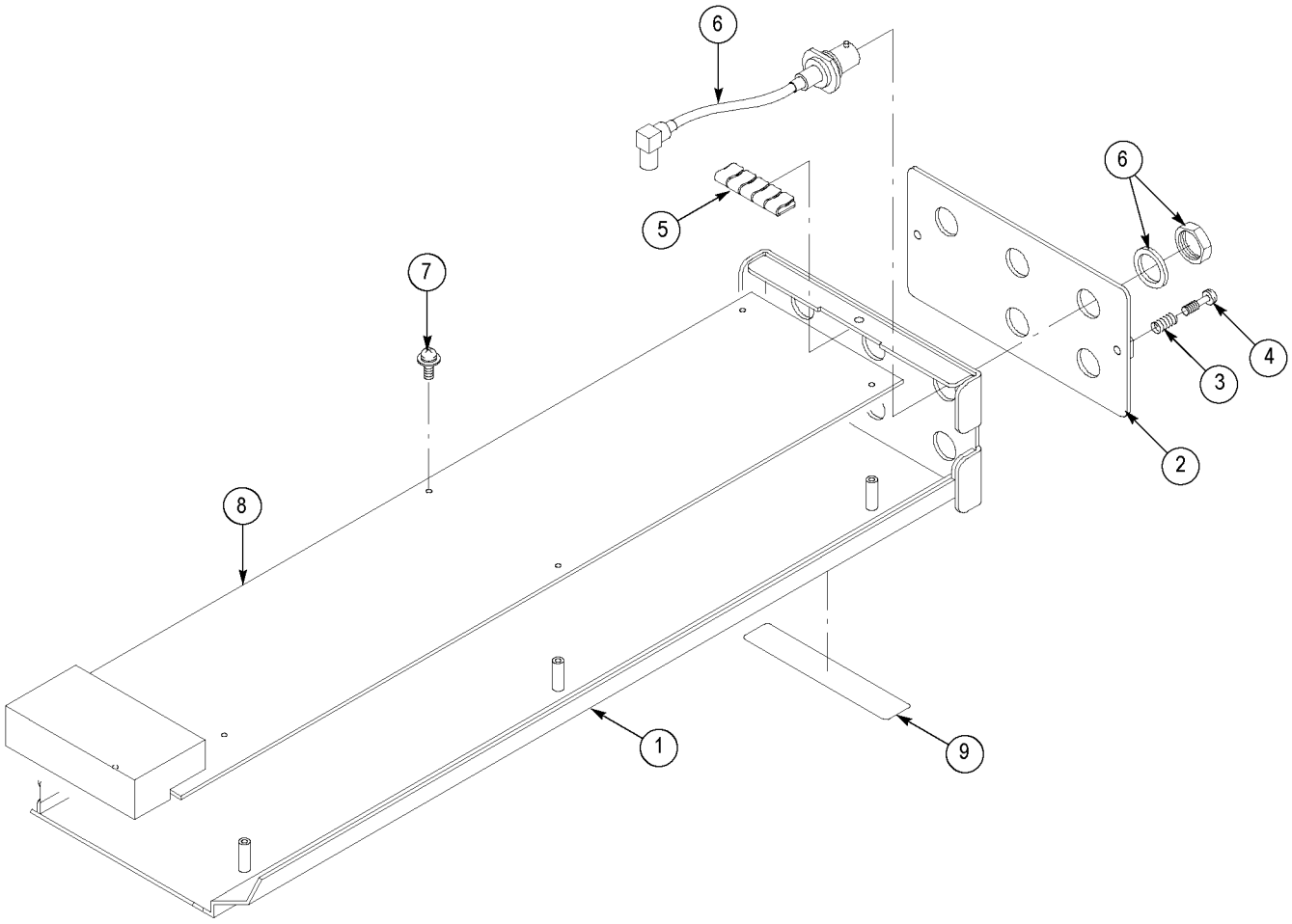



**Figure 11-5: HDLG7 module exploded view**

# HDVG7 HDTV Digital Video Generator

# HDVG7 HDTV Digital Video Generator Theory of Operation

This section describes the basic operation of the major circuit blocks in the HDVG7 Generator module.

**Bus Interface** This block provides the communication between the mainframe and the module circuit.

**Address Generator** This block consists of a frame delay, an MPU interface, a sequencer, an SDRAM controller, and a blanking data generator. It interfaces the Frame Memory and the Line Memory and controls the output sequence of the video data in these memories.

**Frame Memory** Frame memory contains a series of pointers that control the order the video lines stored in Line Memory are used to produce serial digital signals.

**Line Memory** Line memory holds the actual sample points which define a serial digital signal.

**Overlay Controller** This block consists of an MPU interface and an overlay controller. It inserts data from the Overlay Memory into the Line Memory data stream to create circular patterns, ID text, and logo.

**Overlay Memory** The memory generates timings to multiplex the line memory data and the overlay data used for a circle, ID text, and logo overlay.

**Formatter** This block consists of a line number and CRC generator, an audio control packet generator, a data packet generator, an MPU interface, and an SRAM controller. It inserts line numbers and embedded audio data in the serial digital signals.

**Audio Memory** The memory contains embedded audio data.

**Serializer** The serializer converts a 20 bits parallel data to SDI signal.

**Black Generator (Option BK Only)** This block generates black or gray (40% gray) signal for the BLACK 1 and BLACK 2 outputs.

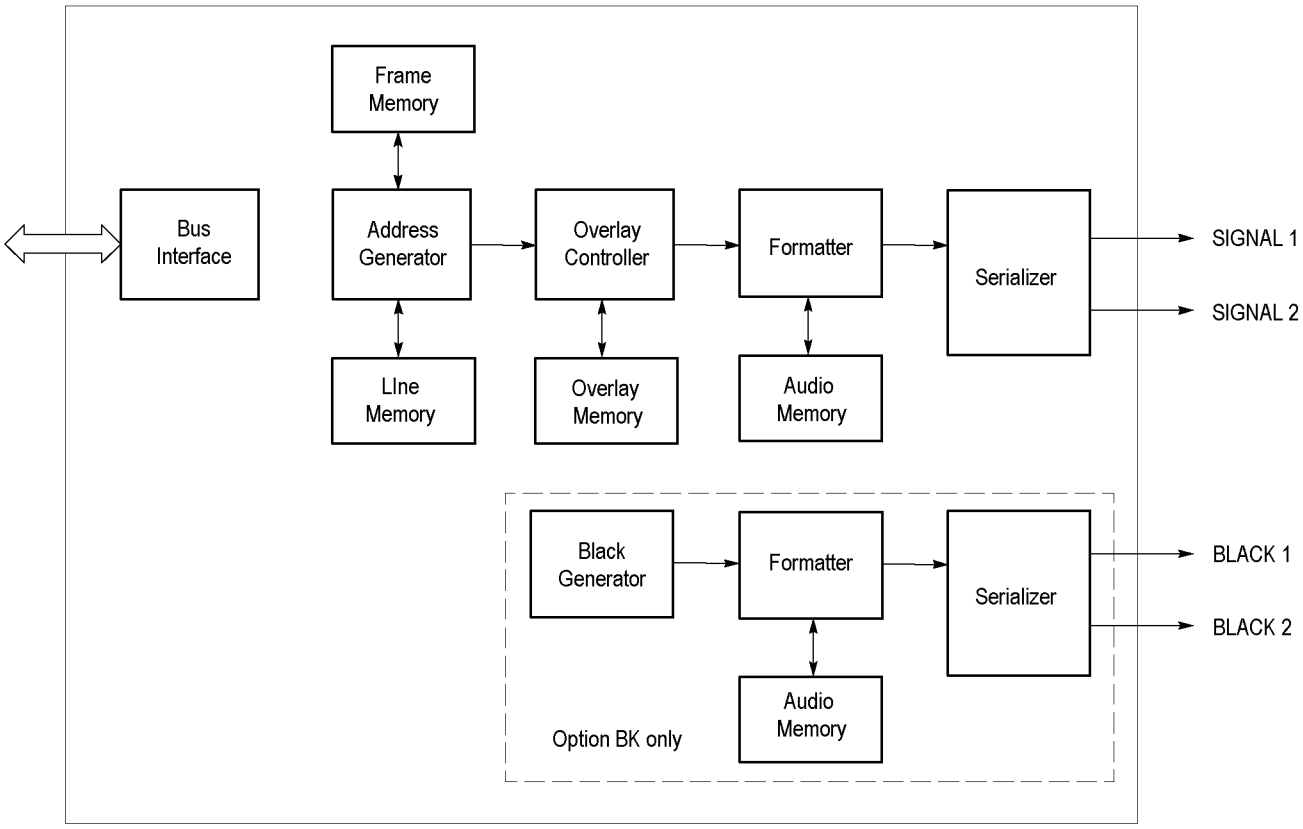



**Figure 12-1: Simplified block diagram of the HDVG7 Generator module**

# HDVG7 HDTV Digital Video Generator Adjustment Procedures

The only adjustment in the HDVG7 Generator module is for the output level.

## Requirements for Adjustment

Before doing the adjustment, note the following requirements.

### Personnel

This procedure is only to be performed by trained service technicians.

### Warm-Up Period

The HDVG7 Generator module requires a 20 minute warm-up time in a +20 °C to +30 °C environment before it is adjusted. Adjustments done before the operating temperature has stabilized may cause errors in performance.

### Access

When adjusting the output level, you need to remove the top cover of the TG700 mainframe. (See page 1-15, *Top Cover*.)

## Equipment Required

The following table lists the equipment required to adjust the output level.

**Table 12-1: Equipment required for HDVG7 HDTV Digital Video Generator adjustment procedures**

| Item | No. | Minimum requirement | Recommended equipment |
|---|---|---|---|
| TV signal generator platform | 1 | | Tektronix TG700 |
| Sampling Oscilloscope | 1 | Bandwidth: 6 GHz or higher | Tektronix DSA8200 |
| 75 Ω BNC cable | 1 | Length: 42 inches | Tektronix part number 012-0074-00 |
| 50 Ω BNC to SMA adapter | 1 | | Tektronix part number 015-1018-00 |
| 75 Ω coaxial terminator | 1 | | Tektronix part number 011-0102-01 |
| 75 Ω signal adapter | 1 | Bandwidth: 1 GHz Amplitude precision: –3 dB | Tektronix AMT75 |

## Output Level Adjustment

### Preparation

To perform the output level adjustment, you must first remove the top cover of the TG700 mainframe. (See page 1-15, *Top Cover*.)

After you have removed the top cover, find the variable resistors on the HDVG7 circuit board. (See Figure 12-2.)

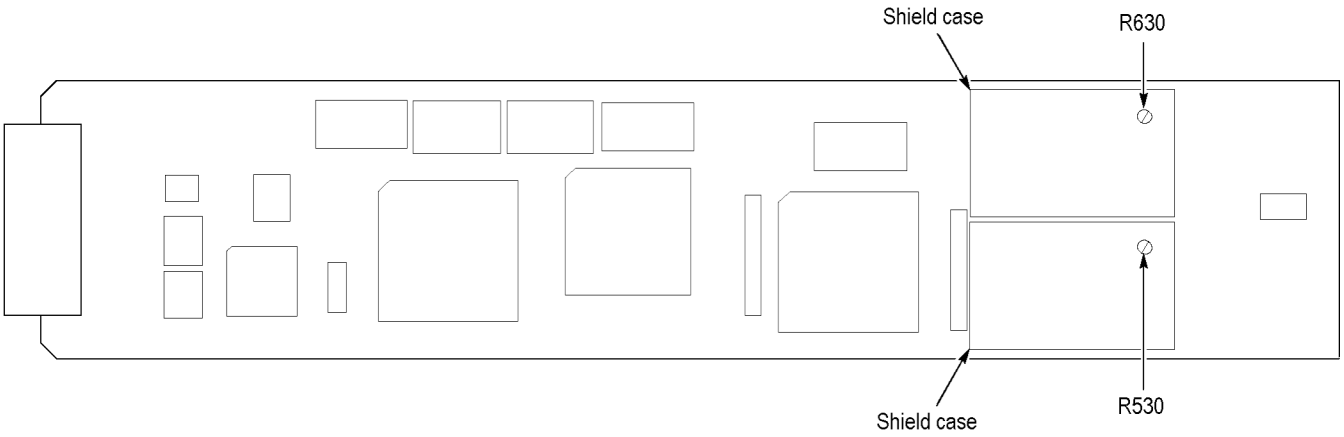



**Figure 12-2: HDVG7 circuit board view**

## Procedure

***WARNING.*** *To avoid serious injury, do not touch exposed connectors or components when operating the TG700 mainframe with the top cover removed. Dangerous potentials exist at several points within the TG700 mainframe.*

1. Use the 75 Ω BNC cable, 75 Ω signal adapter, and SMA-to-BNC adapter to connect the SIGNAL 1 connector on the HDVG7 Generator module to the CH1 input connector on the oscilloscope as shown. (See Figure 12-3.)

***NOTE.*** *Some sampling oscilloscopes do not automatically adjust their readouts to account for the ÷5 attenuation of the AMT75. You must remember to account for this attenuation while viewing the oscilloscope readouts if you are using an oscilloscope of this type.*

2. Use the 75 Ω coaxial terminator to terminate the SIGNAL 2 connector on the HDVG7 Generator module.

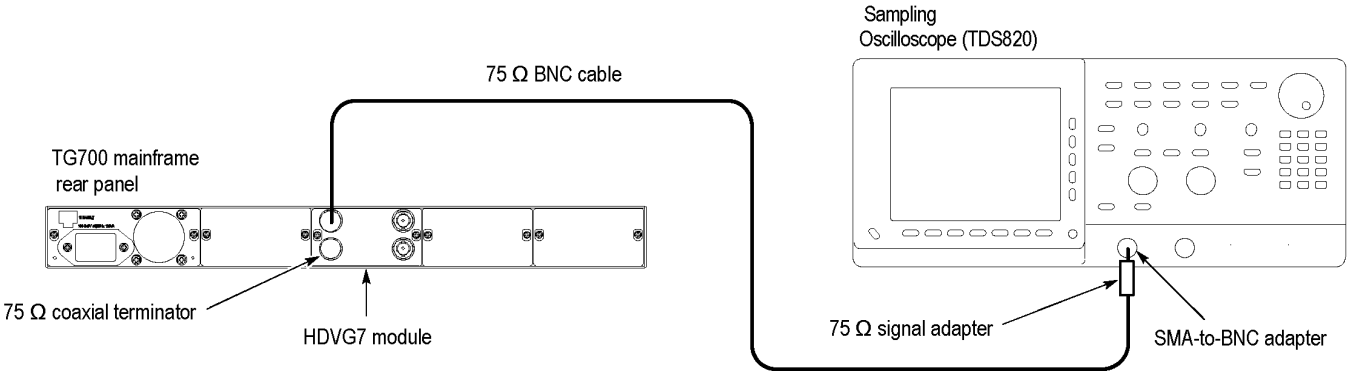



**Figure 12-3: Equipment connection for adjusting the output level**

3. Set the sampling oscilloscope settings as indicated below:

| | |
|---|---|
| Vertical | 30 mV/div |
| Horizontal | 200 ps/div |
| Trig Position | 50 % |
| Main Position | 700 ps |
| Trig Level | 0 V |
| Trig Slope | Rising Edge |
| Acquire Menu | Normal |
| DISPLAY | Variable persistence: 500 ms |

4. Recall the Factory Default preset as follows:
   a. Press the up (▲) or down (▼) arrow button to select **RECALL**.
   b. Press the left (◄) or right (►) arrow button to select **Factory Default**.
   c. Press the **ENTER** button to recall the factory default settings.
   d. Press the **CANCEL** button to return the TG700 main menu.
5. Select the **75% Color Bars** signal as follows:
   a. Press the MODULE button to display the **HDVG7** main menu.
   b. Press the **COLOR BAR** test signal button until the **75% Color Bars** signal is selected.
6. Turn on the "Cursor: HBars" of the sampling oscilloscope, and then set the nV to 159.6 mV.
7. Change the cursor mode to Track, and then position the cursors so that they are symmetrical about the center graticule.
8. Locate variable resistor R530 on the HDVG7 circuit board. (See Figure 12-3.)
9. Adjust the R530 so that the signal amplitude is equal to the height between the two cursors set in step 6.

**BLACK Output Level Adjustment (Option BK Only).**

1. Move the BNC cable connection from the SIGNAL 1 connector to the BLACK 1 connector and move the 75 Ω terminator from the SIGNAL 2 connector to the BLACK 2 connector on the HDVG7 Generator module.
2. Select the **40% Flat Field** signal as follows:
   a. Press the **CANCEL** button to return the module main menu.
   b. Press the up (▲) or down (▼) arrow button to select **BLACK (OPTION)**.
   c. Press the **ENTER** button to access the BLACK submenu.
   d. Press the up (▲) or down (▼) arrow button to select **SIGNAL**.
   e. Press the left (◄) or right (►) arrow button to select **40% Flat Field** and press the **ENTER** button.
3. Locate the variable resistor R630 on the HDVG7 circuit board. (See Figure 12-3.)
4. Adjust the R630 so that the signal amplitude is equal to the height between the two cursors set in step 6.

This completes the output level adjustment procedures.

# HDVG7 HDTV Digital Video Generator Maintenance

This section contains instructions and procedures for maintaining the HDVG7 Generator module. Before following these procedures, read *Maintenance for Generators and Modules*. (See page xix.)

The following information can be found in this section:

- Removal and Replacement (See page 12-8.)
- Troubleshooting (See page 12-10.)

If the instrument does not function properly, troubleshooting and corrective measures should be taken immediately to prevent additional problems.

***NOTE.*** *Contact your local Tektronix representative for information on where to return your instrument if it requires repair during the warranty period.*

# HDVG7 HDTV Digital Video Generator Removal and Replacement

This section contains the instructions on how you can remove and replace the customer replaceable parts of the HDVG7 Generator module.

## Tools Required

The following tools are required to perform the removal and replacement procedures:

**Table 12-2: Required tools for removal and replacement of HDVG7 HDTV Digital Video Generator**

| Name | Description | Tektronix part number |
|---|---|---|
| Screwdriver handle | Accepts Phillips-driver bits | |
| #1 Phillips tip | Phillips-driver bit for #1 size screw heads | |
| #2 Phillips tip | Phillips-driver bit for #2 size screw heads | |
| Nut driver, 14 mm | Special nut driver for removing the BNC connectors of the HDVG7 module | 003-A041-00 |

## Replacing the Rear-Panel Connectors and Chassis

It is usually not necessary to replace the rear-panel connectors or chassis. However, if a connector or chassis becomes damaged, you can replace it.

### Replacing the Rear-Panel Connectors

Perform the following procedure to replace the rear-panel connector:

1. Use the *Removing a Module* section to remove the HDVG7 Generator module from the mainframe. (See page 1-41, *Removing a Module*.)
2. Disconnect the cables at P500 (SIGNAL 1) and P502 (SIGNAL 2) on the HDVG7 circuit board. If Option BK is installed, also disconnect the cables at J800 (BLACK 1) and J802 (BLACK 2).
3. Use the 14 mm nut driver to remove the nut securing the damaged connector to the chassis. Pull the connector away.
4. Perform steps 2 and 3 in reverse order to replace the connector.

## Replacing the Chassis

Perform the following procedure to replace the chassis:

1. Use the 14 mm nut driver to remove the nuts from each of the rear-panel connectors.
2. Use a screwdriver with a #2 Phillips tip to remove the six screws securing the circuit board to the chassis.
3. Lift the circuit board up and away from chassis, and then place it on a static free surface.
4. Set the replacement chassis on a firm, flat, static-free work surface.
5. Carefully place the circuit board in place on the chassis.
6. Use a screwdriver with a #2 Phillips tip to install the six screws securing the circuit board to the chassis.
7. Apply the rear panel to the chassis, and then install all the rear-panel connectors to the chassis.

# HDVG7 HDTV Digital Video Generator Troubleshooting

This section contains instructions and procedures for troubleshooting the HDVG7 Generator module. These procedures will help you decide whether it is necessary to replace your module.

If the TG700 mainframe does not boot up or if the display is not working, refer to the *TG700 Mainframe Troubleshooting* section in this manual.(See page 1-24, *TG700 Mainframe Troubleshooting*.)

## Equipment Required

The equipment listed in the following table is required for troubleshooting.

**Table 12-3: Equipment required for HDVG7 HDTV Digital Video Generator troubleshooting**

| Equipment description | Minimum requirements/example |
|---|---|
| Screwdriver handle | Accept Phillips-driver bits |
| #1 Phillips tip | Phillips-driver bit for #1 size screw heads |
| TG700 mainframe | A TG700 mainframe that is functioning correctly. |

## Backing Up the Instrument Settings

Before you begin the troubleshooting procedures, create a preset to save your instrument settings as follows:

1. Press the **MODULE** button until the mainframe main menu (TG700: PRESET) appears.
2. Press the **ENTER** button to access the PRESET submenu.
3. Press the up (▲) or down (▼) arrow button to select **SAVE**.
4. Press the left (◄) or right (►) arrow button to select a preset number to save instrument settings.
5. Press the **ENTER** button to save the current instrument settings to the new preset.

After the problem is solved, recall the preset you created.

## Troubleshooting Trees

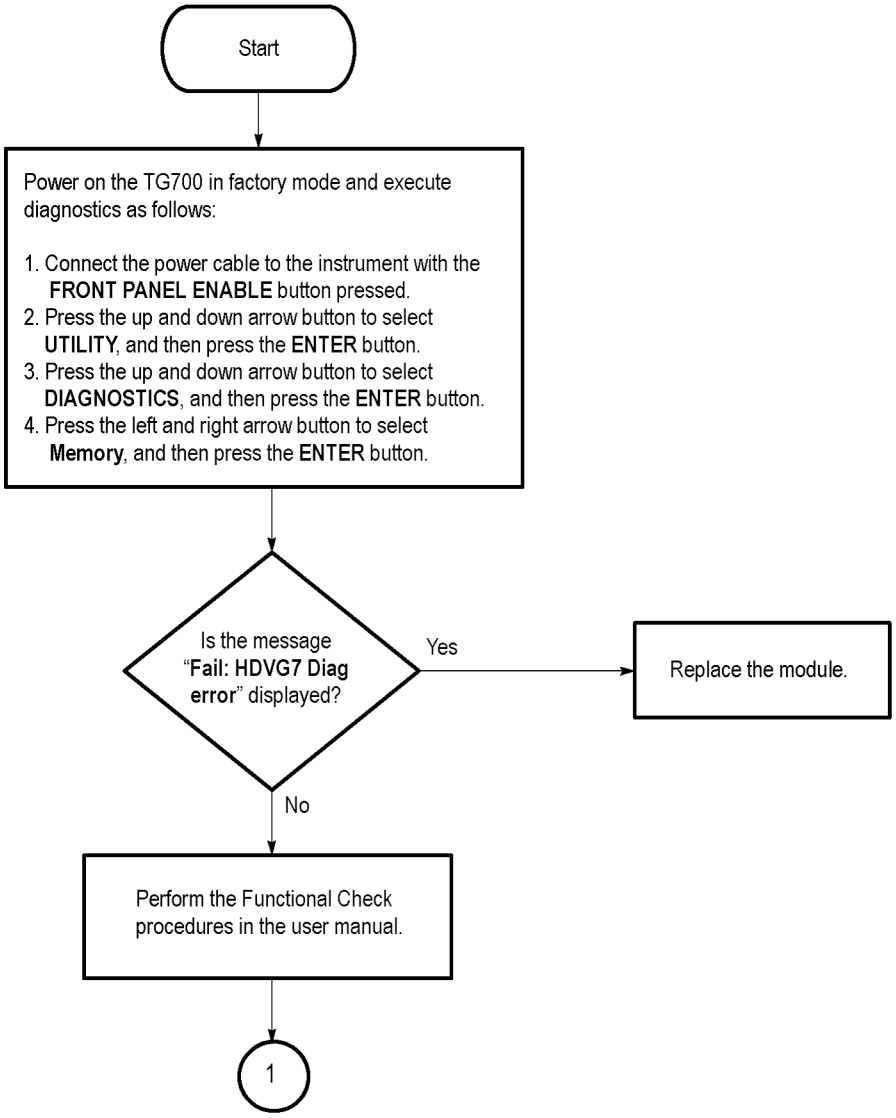

Start
Power on the TG700 in factory mode and execute diagnostics as follows:
1. Connect the power cable to the instrument with the FRONT PANEL ENABLE button pressed.
2. Press the up and down arrow button to select UTILITY, and then press the ENTER button.
3. Press the up and down arrow button to select DIAGNOSTICS, and then press the ENTER button.
4. Press the left and right arrow button to select Memory, and then press the ENTER button.
Is the message "Fail: HDVG7 Diag error" displayed?
Yes
Replace the module.
No
Perform the Functional Check procedures in the user manual.
1

**Figure 12-4: Troubleshooting procedure (1)**

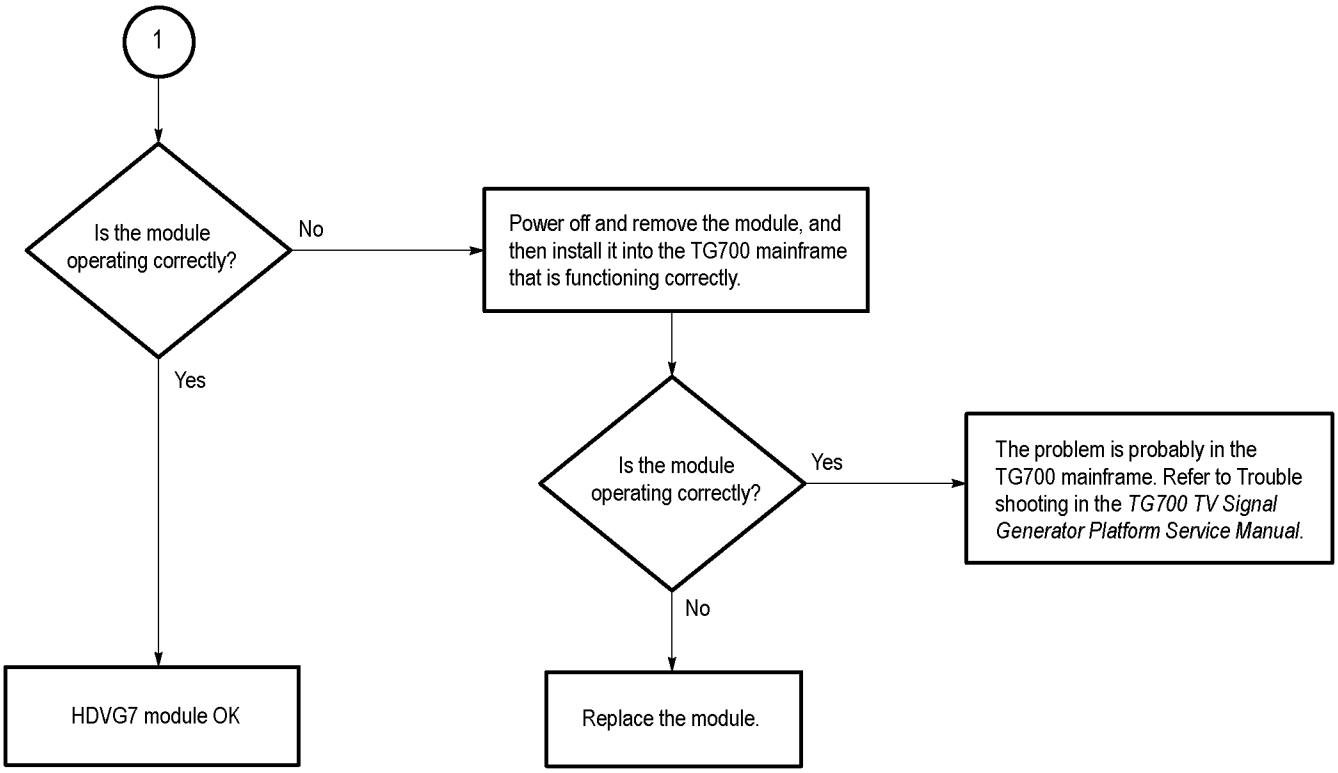

1
Is the module operating correctly?
No
Power off and remove the module, and then install it into the TG700 mainframe that is functioning correctly.
Yes
Is the module operating correctly?
Yes
The problem is probably in the TG700 mainframe. Refer to Trouble shooting in the TG700 TV Signal Generator Platform Service Manual.
No
HDVG7 module OK
Replace the module.

**Figure 12-5: Troubleshooting procedure (2)**

# HDVG7 HDTV Digital Video Generator Diagram

The following figure shows the HDVG7 Generator module and how it interconnects with the TG700 TV Signal Generator Platform.

Diagrams showing mainframe component interconnections, such as power supply and oscillator, can be found in the *TG700 Diagram* section of this manual. (See page 1-28, *TG700 Mainframe Diagrams*.)

A block diagram of the HDVG7 Generator module is located in the *HDVG7 Theory of Operation* section. (See page 12-1.)

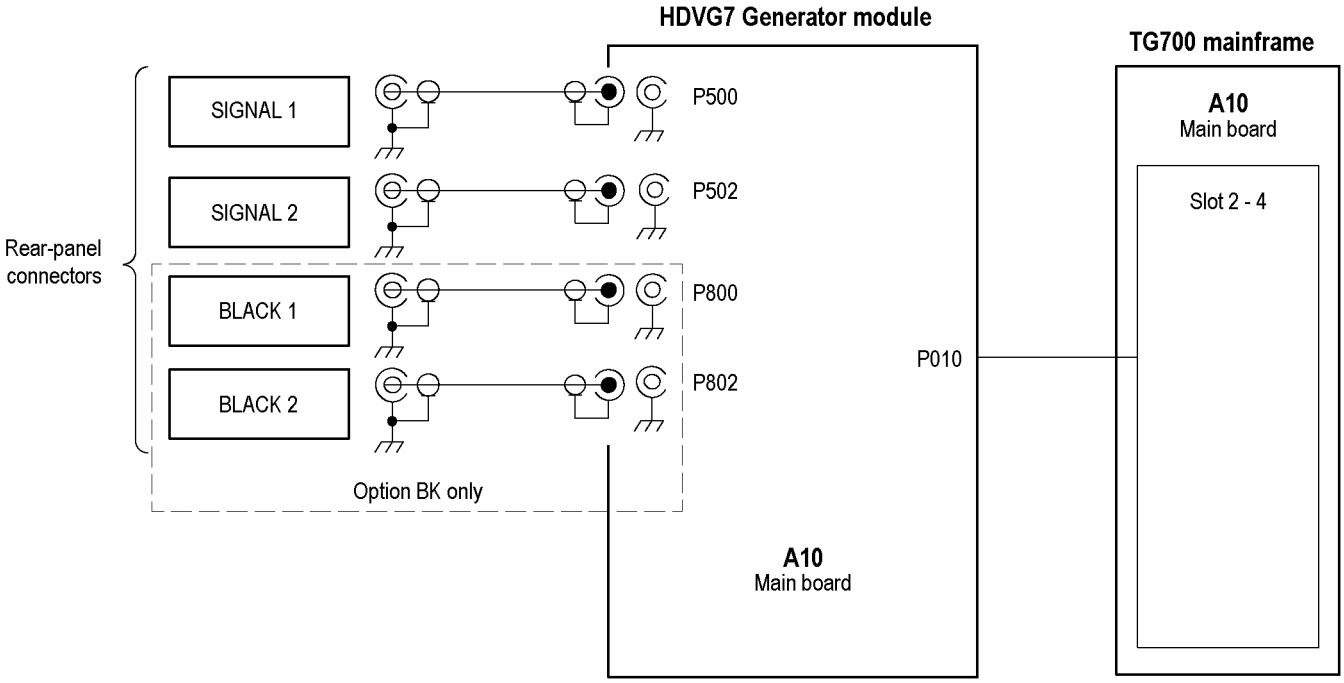



**Figure 12-6: HDVG7 Generator module connections**

# HDVG7 HDTV Digital Video Generator Replaceable Parts List

This section contains a list of the replaceable modules for the HDVG7 Generator module. Use this list to identify and order replacement parts.

## Abbreviations

Abbreviations conform to American National Standard ANSI Y1.1-1972.

### Table 12-4: HDVG7 HDTV Digital Video Generator – replaceable parts

| Fig. & index number | Tektronix part number | Serial no. effective | Serial no. discont'd | Qty | Name & description |
|---|---|---|---|---|---|
| 12-7- | 116-A007-05 | | | 1 | EXCHANGE MODULE:HDVG7 |
| | 116-A008-05 | | | 1 | EXCHANGE MODULE:HDVG7-BK |
| 12-7-1 | 441-A275-00 | | | 1 | CHASSIS,MODULE HDVG7:ASSY |
| -2 | 333-A409-00 | | | 1 | PANEL,REAR:HDVG7,AL |
| | 333-A410-00 | | | 1 | PANEL,REAR:HDVG7 OPTION,AL |
| -3 | 214-4946-00 | | | 2 | SPRING,CONICAL:VXI MOUNTING SCREW,0.26MM |
| -4 | 213-1129-01 | | | 2 | SCREW,MACHINE:M2.5X11MM L,PAN HD,STL,NI PL,CROSS REC & SLOTTED |
| -5 | 348-A128-00 | | | 2.5 CM | SHLD GASKET,ELEK:FINGER TYPE,5.1MM LX6.4MM W,BE-CU [97-645-02] |
| -6 | 174-B846-00 | | | 2 | CABLE ASSY,RF:75OHM,COAX(RG179),6CM L,BNC TO PL71-LP-1.5C |
| | 174-B846-00 | | | 4 | CABLE ASSY,RF:75OHM,COAX(RG179),6CM L,BNC TO PL71-LP-1.5C (OPTION BK) |
| -7 | 211-A245-01 | | | 6 | SCREW,MACHINE:M3X6MM L,PNH,STL,NI PL,CROSS REC,W/KOGATAMARU & LOCK WASHER |
| -8 | 334-1378-03 | | | 1 | MARKER,IDENT:MKD SERIAL NO. |
| -9 | 342-A146-00 | | | 1 | INSULATOR,PLATE:HEAT CONDUCTOR,RUBBER, 20MMX20MMX10MM THK [TC1000-TCK] |
| | 342-A146-00 | | | 2 | INSULATOR,PLATE:HEAT CONDUCTOR,RUBBER, 20MMX20MMX10MM THK [TC1000-TCK] |
| | | | | | **STANDARD ACCESSORIES** |
| | 075-0986-XX | | | 1 | MANUAL,TECH:MODULE INSTALLATION INSTRUCTIONS |
| | 063-3939-XX | | | 1 | KIT: SOFTWARE LIBRARY, DOCUMENTATION DVD |
| | | | | | **OPTIONAL ACCESSORIES** |
| | 003-A041-00 | | | 1 | NUT DRIVER,BOX:14MM HEX,BNC RETAINING NUT, MODIFIED 19MM |

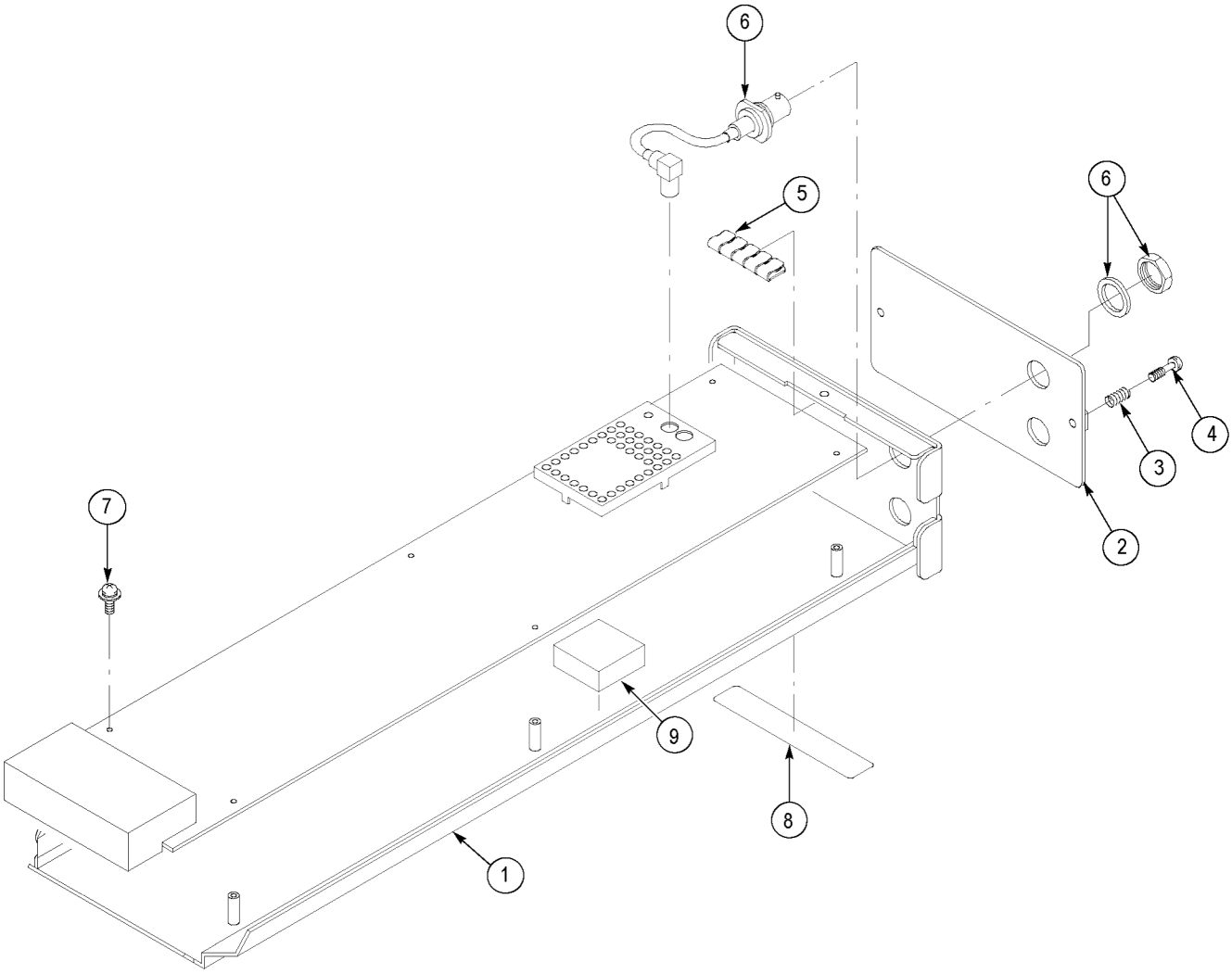



**Figure 12-7: HDVG7 Generator module exploded view**

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